GÜBELIN

GEMMOLOGICAL PROFILE

15.68 CT

COLOMBIAN EMERALD

COMPLEMENTING
GEMMOLOGICAL REPORT

No. Specimen 2

ABOUT THIS DOCUMENT

This Gemmological Profile is complementing a Gemmological Report issued by the Gübelin Gem Lab. The Gemmological Profile has been issued upon request of a client, on the basis of data collected for the described stone at the time of the analysis as stated on the Gübelin Gem Lab Gemmological Report. The Gemmological Profile is only valid if presented together with the original Gübelin Gem Lab Gemmological Report.

Gemmological Profiles provide a more detailed description of a gemstone than the concentrated wording used in Gübelin Gem Lab Gemmological Reports. While Gemmological Reports primarily address the professional traders, Gemmological Profiles attempt to cater the needs of the jeweller and the layperson, who might be interested in getting explanations and background information about gems in general and their gemstone in specific. Gemmological Profiles are issued on request and are available for a broad range of gemstone qualities. Hence, the existence of a Gemmological Profile does not imply any level of quality or rarity of the gemstone it describes. The language used in Gemmological Profiles is more extensive and informal. Statements about certain quality traits of the stone in the Gemmological Profile might be more detailed and go beyond the sober scientific language deployed in the Gemmological Report. In contrast to the Gemmological Report, whose content is based exclusively on data that Gübelin staff has collected directly from the stone, the Gemmological Profile considers and contains also external, possibly uncorroborated data and information.

We refer to the information stated in the Notes and Limitations section on the backside of the Gübelin Gem Lab Gemmological Report and the General Terms & Conditions.

See also gubelingemlab.com.

CONTENT

INTRODUCTION

Gemstones are true products of nature, grown millions of years ago in the earth's crust, brought up to the surface by geological processes and eventually found by man who brings out its colour and brilliance by cutting and polishing.

The gemmologist's eye looks beyond the sparkling outer appearance of the stones, attempting to understand how they have formed. Minute crystals, fluid inclusions and subtle growth features trapped in their interior are witnesses of their formation millions of years ago, and in tens or even hundreds of kilometres depths in the earth. This inner life allows us to detect their identity, authenticity and even their geographic origin.

This Gemmological Profile complements the Gübelin Gem Lab Gemmological Report No. SPECIMEN 2, contained in the inside cover page of this booklet. In this Profile, we present our insights and findings for the 15.68 ct Colombian emerald, disclosing some of its microscopic, chemical and structural characteristics and providing valuable information about its genesis and origin.

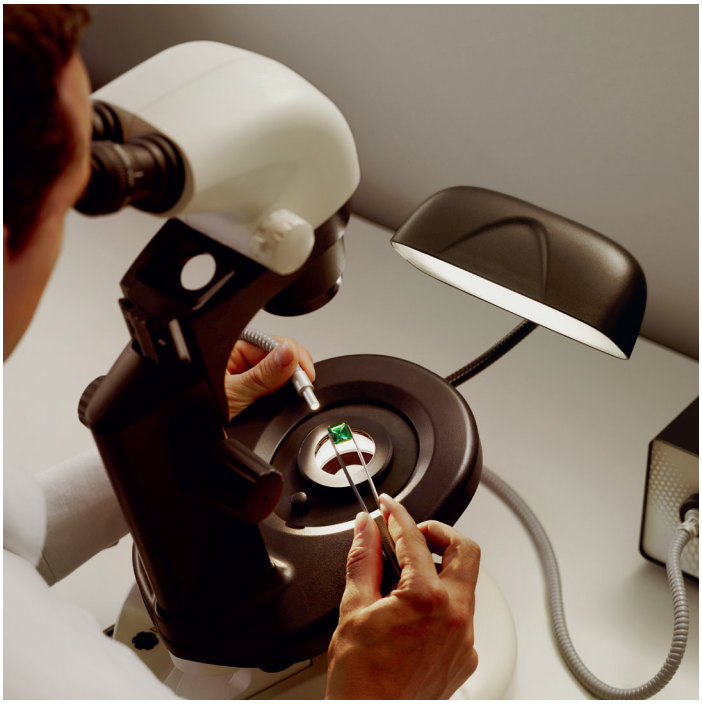
We intend to share with you the story that your gemstone tells us on its very individual history and personality.

On April 24, 2017, the Gübelin Gem Lab in Lucerne has been entrusted with testing the 15.68 ct gemstone presented here. The careful assessment and detailed analytical studies performed on this gemstone revealed the results provided in the Gemmological Report No. SPECIMEN 2 and are described in more detail in this Gemmological Profile.

HISTORY & SYMBOLISM OF EMERALD

The word ‘emerald’ comes to us through the European romance languages from the Latin ‘smaragdus’, transliterated directly from the ancient Greek ‘σμαραγδος’, meaning ‘green stone’ [ACA]. One of the earliest recorded references to emeralds is made in an Egyptian text, ‘The Instruction of Ptah-Hotep’, dating to the middle of the fourth millennium BC. In a reference to their relative scarcity, it was written that “wise words are rarer than emeralds” [ACA]. Both emeralds and the colour green were of great symbolic significance to the ancient Egyptians, representing youth, life, and rebirth. The Romans valued the gem’s curative and empowering properties as an aide to childbirth. By the Middle Ages, emerald was believed to deter demons, cure leprosy, and even hold the power of prophesy. The colour and lucidity was clearly seen to clarify the mind and even the future. That it could also soothe and improve the eyes was recorded by both Greek and Roman natural historians, and was still appearing in literary references as late as Shakespeare [ACA]. In the East, emerald was also regarded as an amulet for success in action, business and war. It was associated with Buddha as one of the nine Navratna stones, and was believed to have originated from the bile of the demon Vala [ACA]. Emeralds feature in the creation myths of other cultures, especially Pre-Colombian. The native Indians of Muzo relate that the emerald belt was formed from either the bodies or tears of the first man and woman. All these historic and legendary records highlight the historic role of the emerald and demonstrate the vast value and respect placed in the emerald since antiquity.

ACA This abbreviation refers to specific contents of the Coloured Gemstone Professional classes provided by Gübelin Academy. For more detailed information visit gubelinacademy.com



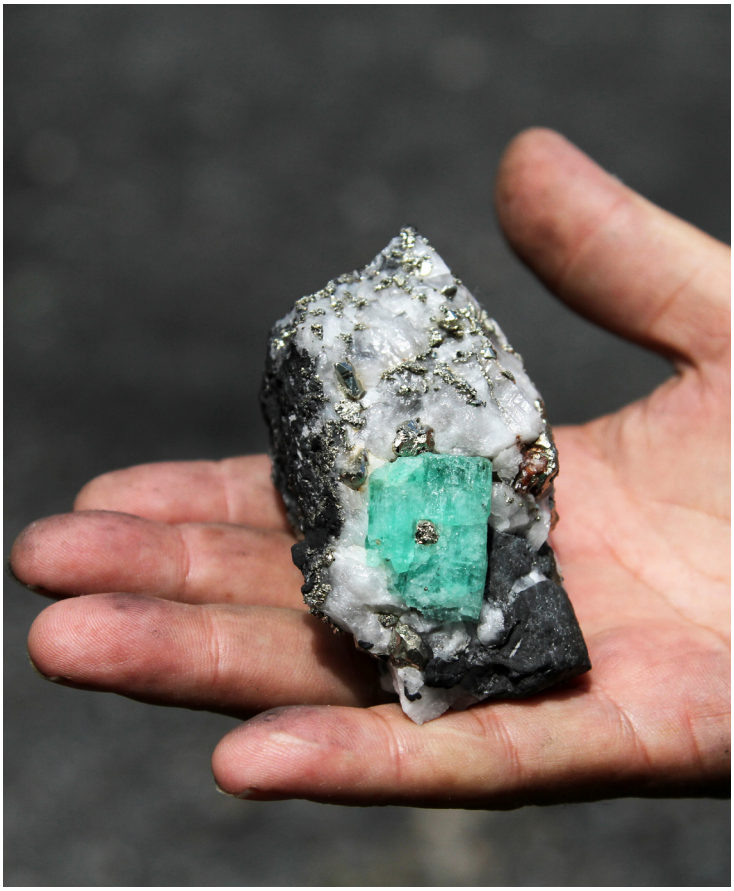
DESCRIPTION

Weight

Emeralds are minerals formed deep in the earth, under specific geologic conditions. Not only is a delicate mineralogical balance essential for this green variety of beryl to be formed, but also specific pressure and temperature conditions. Furthermore, sufficient supply of a rare combination of chemical elements is another necessity required for the formation of emeralds. Beryllium and chromium are two of these key ingredients, the former as a main element, the latter as a trace element. Remarkably, beryllium - a very rare element in itself - tends to get separated from chromium by most geological processes. Even in geologic dimensions of time and space, these two elements finding together is an unusual event, underlining the rarity of emeralds. Due to conditions during their growth, emeralds usually show fissures and fractures throughout the stone. Skilful cutting is needed to bring out the least fractured part of the rough crystal, further reducing the weight of the gemstone typically to less than 50 percent [ACA]. With a final weight of 15.68 ct, the emerald presented here is an extremely large specimen.

Shape & Cut

The final shape and cut of the gemstone is the result of a highly complex decision taken by the cutter, and mainly defined by the shape and the quality of the rough crystal. The cutter tries to find a balance between maximising the colour, brilliance and transparency, while retaining as much weight of the crystal as possible. Special attention is given to the appearance of the colour, the key property in all coloured gemstones [ACA]. Emeralds grow in an oriented manner, resulting in differences of colour - sometimes subtle, sometimes distinct - when viewed from different directions. This effect, called pleoch-



roism [ACA], is carefully considered by the cutter, and plays a pivotal role in getting the best out of a piece of rough crystal.

These considerations were also skilfully applied on the present crystal. It was fashioned into a cushion shape, using a modified brilliant cutting style. The dimensions of the gemstone are 15.91 mm in length, 15.57 mm in width and 9.09 mm in depth.

The cutting and polishing applied on this stone enhance its beauty effectively, resulting in a very attractive appearance of this emerald.

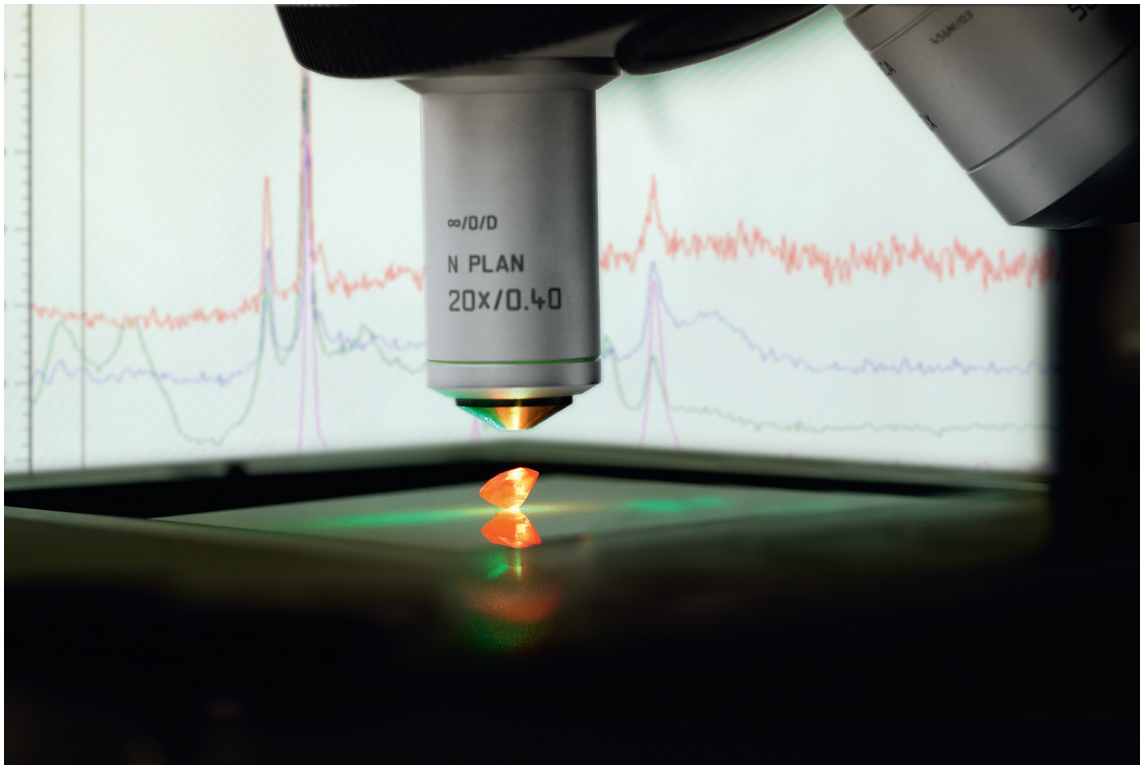
Colour

One of the most important criterion of a gemstone's quality is its colour. Emeralds cover a palette of green nuances, sometimes with a subtle contribution of a secondary colour such as blue or yellow, and resulting in shades ranging from pale leaf green through to a dark fir green. While all hues have their own charm and legitimacy, a pure, saturated grass green colour is the most coveted amongst connoisseurs. The present gem is characterised by an intense, saturated and homogeneous green colour, free of any seondary hue.

Transparency
In emeralds, the transparency and clarity are quality characteristics nearly as important as the colour. As a rule of thumb, the transparency of gemstones usually follows the same logic as in diamonds: the cleaner the better. However, part of the lure of emeralds is due to inclusions - minute fissures, tiny crystals, or subtle fluid inclusions - trapped in the stone, a trait intrinsic to creating the appearance emeralds became famous for. While these features are a common and welcome feature in emeralds, ideally they do not affect the transparency of the stone. The 15.68 ct emerald presented here is slightly included. One of the most typical clarity characteristics of emeralds are fissures, imposed by tectonic forces during the growth of the emeralds, and potentially affecting the transparency of the stone. The present gemstone is slightly fissured, a characteristic typically observed even in gem-quality emeralds. By filling these fissures and fractures with a foreign substance such as oil, resin or wax, the transparency of the emerald can be enhanced (see also the chapter on treatment further below.)

Identity & Authenticity
One most fundamental information any gem lab report has to provide is the identity of the stone. Emerald is a member of the beryl family, its chemical composition being beryllium aluminium silicate. The green colour of emerald is due to traces of chromium and/or vanadium found throughout the mineral [ACA]. Each chromium ion replaces one aluminium ion, a phenomenon that distinguishes the emerald from a beryl.

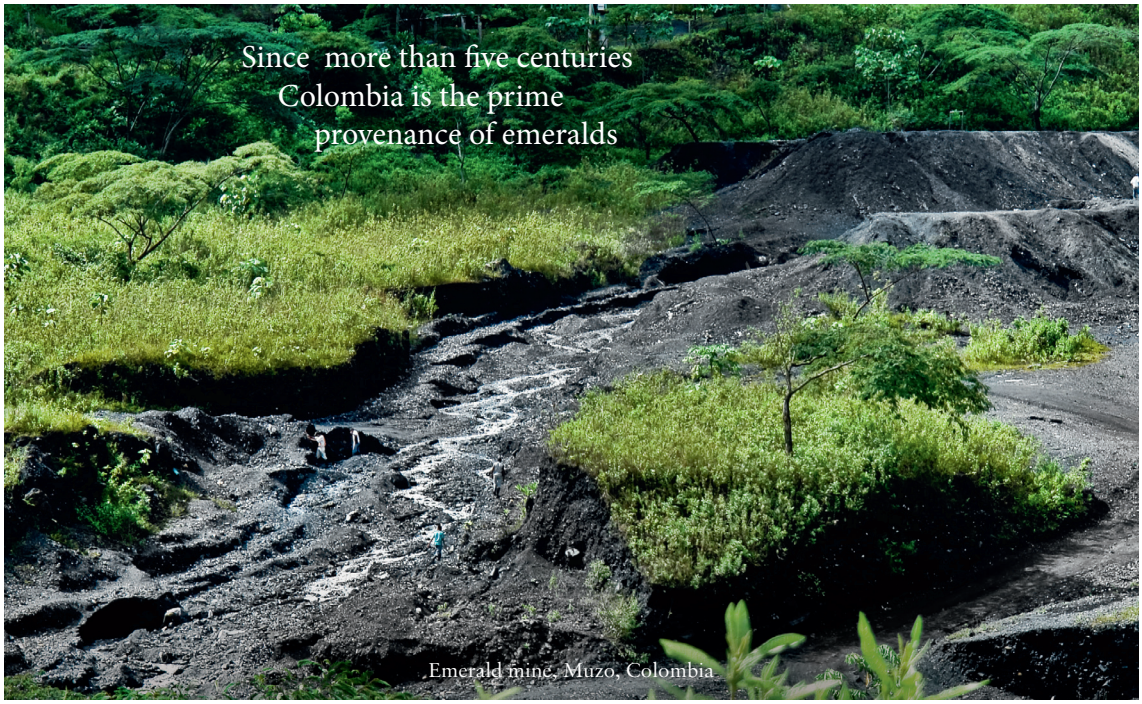
The higher the amount of chromium, the more intense the green colour. However, the reduced amount of alumina causes the crystal structure to weaken, a factor that increases the brittleness of the emerald. Different materials might be used to fake emerald, acting as so-called simulants. Clearly, the value of a simulant is a fraction only of the true em-



erald. As emeralds can also be grown synthetically, the authenticity needs be addressed; is the emerald indeed of natural provenance, i.e. grown millions of years ago in the depth of the earth, or if it is a synthetic emerald, i.e. a man-made crystal? Synthetic emeralds are known since the late 1920s, and possess chemical and physical properties almost identical to natural emeralds. But the production and hence the supply of synthetic emeralds is virtually unlimited, which reduces their value dramatically compared to a pristine, naturally grown emerald. The 15.68 ct gemstone has proven to be of the green variety of natural beryl, called emerald.

Overall quality assessment

The 15.68 ct emerald described in Gübelin Gemmological Report No. SPECIMEN 2 is of very high visual quality.



Emerald mine, Muzo, Colombia

ORIGIN

Throughout history, gemstones – in particular rubies, sapphires and emeralds – have been associated with specific countries and mining localities by virtue of their outstanding beauty and quality. However, the outward splendour of a gemstone is not all that contributes to the prominence of a particular source. The history and notoriety – often tumultuous – with which many exceptional gemstones are associated, have contributed greatly to the reputation of a few specific gem deposits. The country of origin of the present 15.68 ct emerald has been determined to be Colombia, known since more than five centuries as the prime provenance of emeralds [ACA].

History of the Colombian Emerald Mines

One area in the north-east of Colombia's capital Bogota homes the majority of the country's production, the aptly named 'Emerald Belt'. Running in a north-west to south-east direction, the belt is based in the Cordillera Oriental of the Andes mountains, between 600 and 1,200 m above sea level. The belt itself is separated into two mining areas, known as the Eastern and Western Belts. Of the historically richest and best renowned mines, Chivor, also known as Somondoco, is positioned within the Eastern Belt, and the Muzo and Coscuez mines within the Western Belt.

Long before the arrival of European explorers, Colombian emeralds were already being worked for hundreds of years by the native Chibcha Indians, and traded between the various indigenous cul-

tures into Peru, Ecuador, Central America and Mexico. Local trade was sufficiently developed with the Aztecs and Incas that, initially, the Spanish conquistadors believed that the emerald mines they were seeking were based in Mexico or Peru. The Chivor mines were finally located in 1537, and their emeralds not only have the longest history of all Colombian emeralds, but are also famed for their classic deep bluish-green hue.

Equally high reputation receive the Muzo emeralds in the Western Belt, displaying a warm and almost velvety, grassy yellowish-green colour and high transparency. Muzo emeralds have created a continual fascination from their South American origins across Europe, to the Middle and even Far East. In contrast to Chivor, the discovery of the Muzo mines was a far greater challenge for the Spanish Conquistadors. The local Muzo Indians withheld their exact location and protected their local resource from the Spanish for twenty years. After their discovery by the European invaders at the end of the 16th century, Muzo (probably together with Coscuez) became the preeminent emerald producer in Colombia. Since then, and with only sporadic breaks, Colombian emeralds keep coming to the global market consistently. While mining of coloured gemstones usually is erratic and ephemeral, the continuity of supply of Colombian emeralds, together with their size and quality, explains their worldwide recognition and appreciation[ACA].

Determination of Origin

The geographic origin of this emerald has been determined by comparing its gemmological properties with those of emeralds from the reference collection of the Gübelin Gem Lab. With more than 27,000 stones, it is probably the world's most complete collection of gemstones gathered from all commercially relevant mines worldwide. The collection has been started in the 1930s and is maintained up to this day. It hence also encompasses mines which are exhausted or closed decades ago. This unique reference collection, combined with the most sophisticated analytical techniques, allows the scientists of the Gübelin Gem Lab to determine the origin of almost all emeralds, solely based on the observations and data they collect on the stone.

If the pattern of properties gathered from the unknown stone matches the one from the reference stones, i.e. of secured provenance, an origin can be determined. However, this is sometimes not a straightforward process, as the properties of emeralds from different deposits might overlap. Although today they might lie thousands of kilometers apart, their geologic setting might be similar, or the host rocks were even adjacent to each other millions of years ago when the gem grew. Hence, despite skilful assessment and evaluation of carefully collected analytical data, the determination of the origin is not feasible for any stone. The trustworthiness of the final opinion is – among other factors – defined and limited by the completeness and quality of the lab's knowledge database and reference collection. This is why the Gübelin Gem Lab continuously invests a significant share of its revenues in research and development, both in-house as well as in joint projects with universities and other external scientific research institutions[1].

[1] The annual 'Dr. Eduard Gübelin Research Scholarship' is another key engagement of Gübelin to contribute to the advancement of gemmological knowledge. For more information visit www.gubelingemlab.com/scholarship.

GEOLOGY & AGE

The genesis of the Colombian emeralds is related to the formation of the Andean mountains. Here, the Nazca plate - the oceanic plate of the Eastern Pacific - gets subducted underneath South America, and forms a part of the 'Pacific Ring of Fire'. This tectonic event is ongoing to this day, at an average rate of several centimetres per year. The resulting geologic activity caused the formation of the Cordillera Oriental, and the mineralisation of emeralds in host rocks of black shale. The growth of the emeralds was facilitated by hot, briny fluids that leached chemical elements, e.g. chromium, from the black shale, and were incorporated into the emeralds. Radiometric dating techniques indicate that most of the Colombian emeralds were formed some 30 to 38 million years ago. While to most people this might seem very old, Colombian emeralds are in fact fairly young in geologic terms, at least in comparison to Zimbabwean emeralds that formed 2,600 million years ago [ACA].

Major emerald deposits

TREATMENT

Induced by the tectonic conditions during their growth, emeralds are prone to fracturing. The brittleness of the crystal structure of beryl in general, and emerald in specific, is even furthering the formation of fractures and fissures. Despite skilful cutting a few fissures remain in virtually all emeralds, even the very fine ones. Depending on the number, size, position and orientation of the fissures, they might lower the transparency of the gem, or even affect its stability. By filling these fissures and fractures with a foreign substance such as oil, resin or wax, their presence can be masked, and the transparency of the emerald can be enhanced. Such a procedure - referred to as clarity enhancement - is considered a treatment and needs be disclosed on gem lab reports which nowadays accompany most emeralds. Labs apply a grading system to quantify the degree of clarity enhancement, typically ranging from insignificant, minor and moderate to significant [ACA]. The present 15.68 ct emerald shows indications of minor clarity enhancement, an extent of treatment the trade broadly considers acceptable. Clarity enhancement of emeralds is a reversible and repeatable process and fissures may be filled and cleaned multiple times during their life as a gemstone. This is especially true when oil is used as a filling agent because oil dries out over time and it can leak out when heated or when surrounding air pressure is changed. But generally, all types of filling material, including epoxy and resins, can be removed. The reversibility and repeatability of this process implies a possible change of appearance of the stone and might also apply to the stone presented here.

WITHIN EMERALD

Careful study of the internal features and properties gives valuable insights into the identity, authenticity and sometimes the origin of a gemstone. All these characteristics are the result of the individual history of this specific gemstone, providing a patchy and fragmented - but very personal - diary from its growth in the inner of the earth, its uplift to the surface, to the mining process and finally the processing by man.

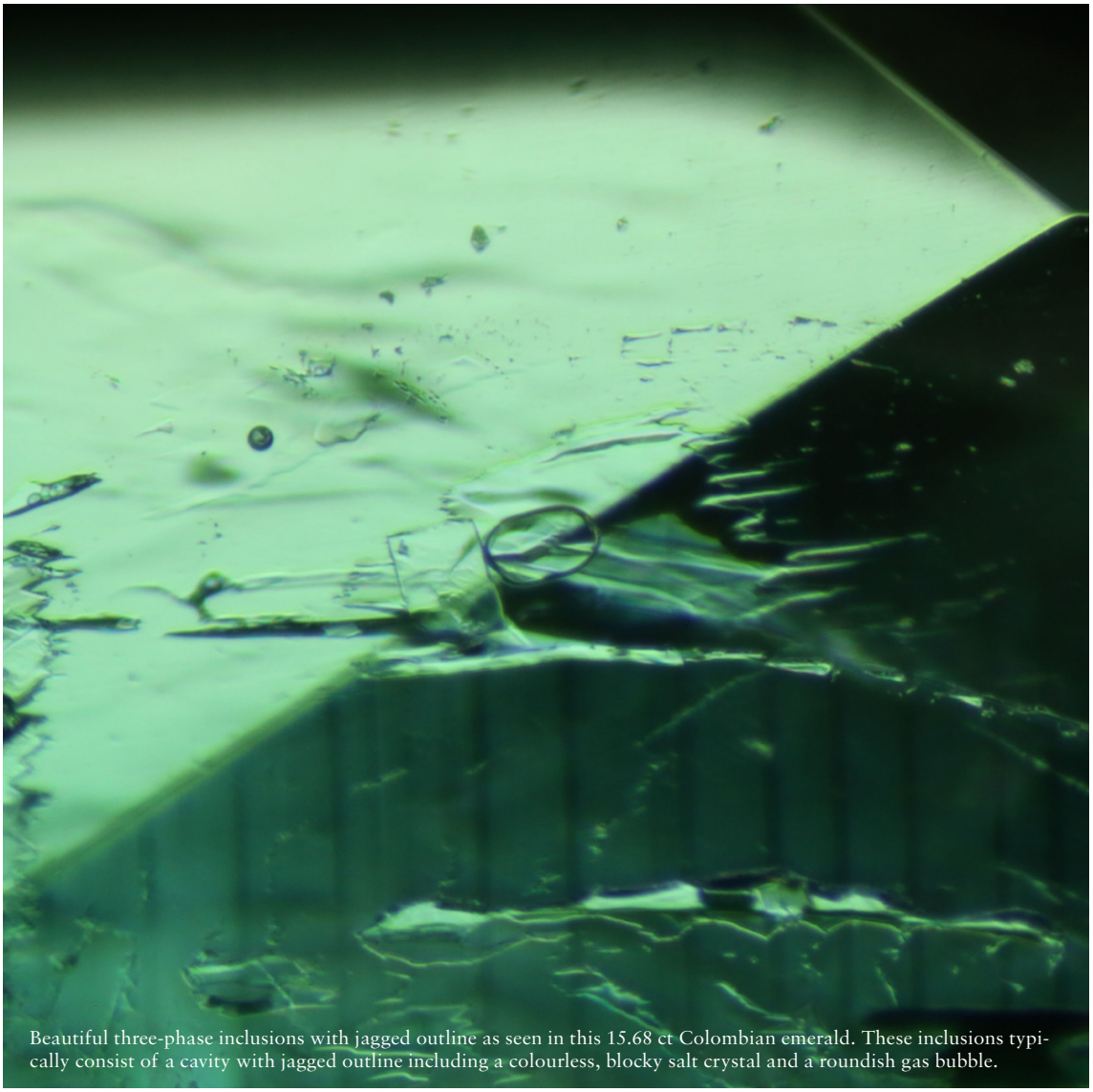
The growth of the crystal is controlled by the geological setting in which the mineral formed, the pressure and temperature conditions and the specific chemical environment prevailing at that time. To unravel these secrets from this 15.68 ct emerald, the scientists at the Gübelin Gem Lab have scrutinised its microscopic features, analysed its detailed chemical composition and its physical-structural properties.

Microscopic features
In combination with the magnifying aid of a microscope, the experienced human eye provides an extremely sensitive, powerful and versatile analytical tool. The determination and description of the microscopic characteristics found in a gem - ranging from tiny crystals, fluid inclusions and particles, to growth features and minute fissures - provide a comprehensive qualitative survey indispensable for any gemmological conclusion.

Some of the internal features recorded in this emerald include three-phase fluid inclusions with a jagged outline, roiled growth structures also referred to as the 'gota de aceite' - effect and lozenge-shaped crystal inclusions. These inclusions are regularly observed in Colombian emeralds and are potentially helpful indicators to determine their authenticity and origin[2].

Further to these characteristic inclusions, straight and angular growth structures are other internal features present in this 15.68 ct emerald.

2 For more information about the inclusions in gemstones contact the Gübelin Academy or consult 'Photoatlas of Inclusions in Gemstones' (see chapter 'Addendum')



Beautiful three-phase inclusions with jagged outline as seen in this 15.68 ct Colombian emerald. These inclusions typically consist of a cavity with jagged outline including a colourless, blocky salt crystal and a roundish gas bubble.

Chemical features

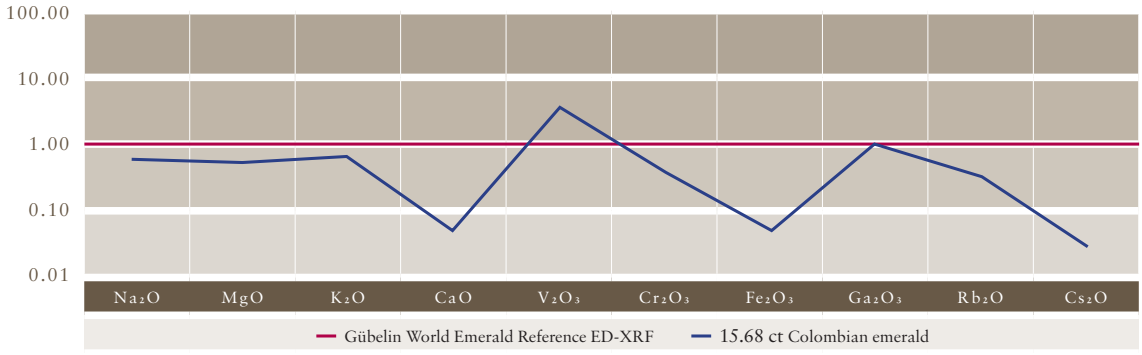
In addition to microscopic features, a number of technologically advanced analytical methods are deployed to contribute to a secure determination of a gemstone's authenticity and origin. These more sophisticated methods can be grouped into spectroscopic and chemical methods. Both types give hints to the type of rock in which the gem formed, and might also reflect alterations imposed by a possible treatment process.

Sophisticated analytical techniques[3] measure the concentration of chemical elements in gems. Aside from the main and minor elements, gemstones also contain other elements present in even smaller concentrations of a few parts per million. These trace elements typically do not have any significant influence on the appearance of the gemstone, but they shed light on the environment in which it grew thousands, millions or even billions of years ago. The type and amount of these elements in a gemstone are often indicative of a specific location and are used by gem labs to determine its country of origin.

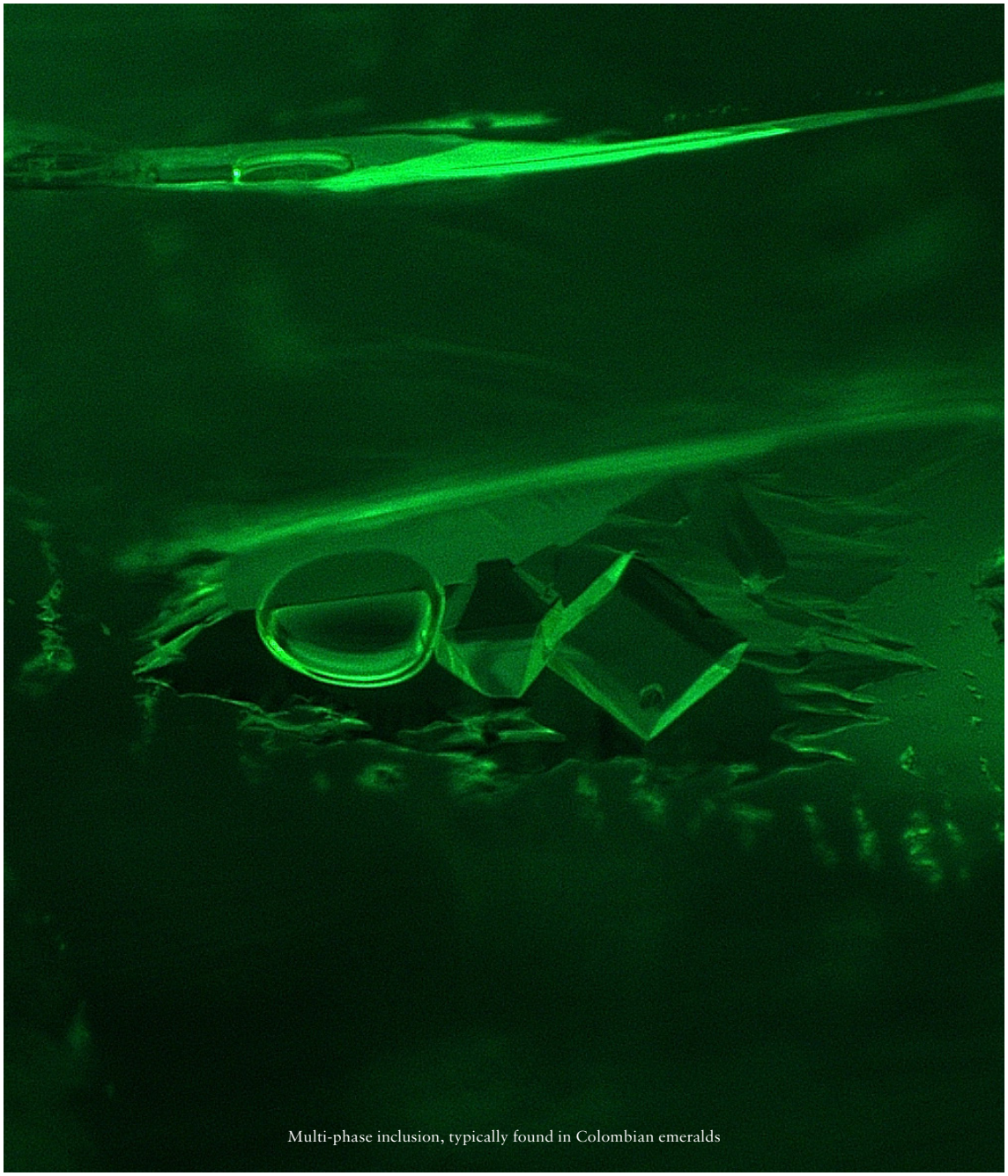
The trace element concentrations of this 15.68 ct ruby vary slightly to the Gübelin World Ruby Reference4, as shown in the trace element diagram. The individual and truly unique chemical fingerprint measured in this 15.68 ct gemstone displays the characteristic deviations we expect for a ruby from Colombia.

[3] For more information about the applied analytical methods visit www.gubelingemlab.com

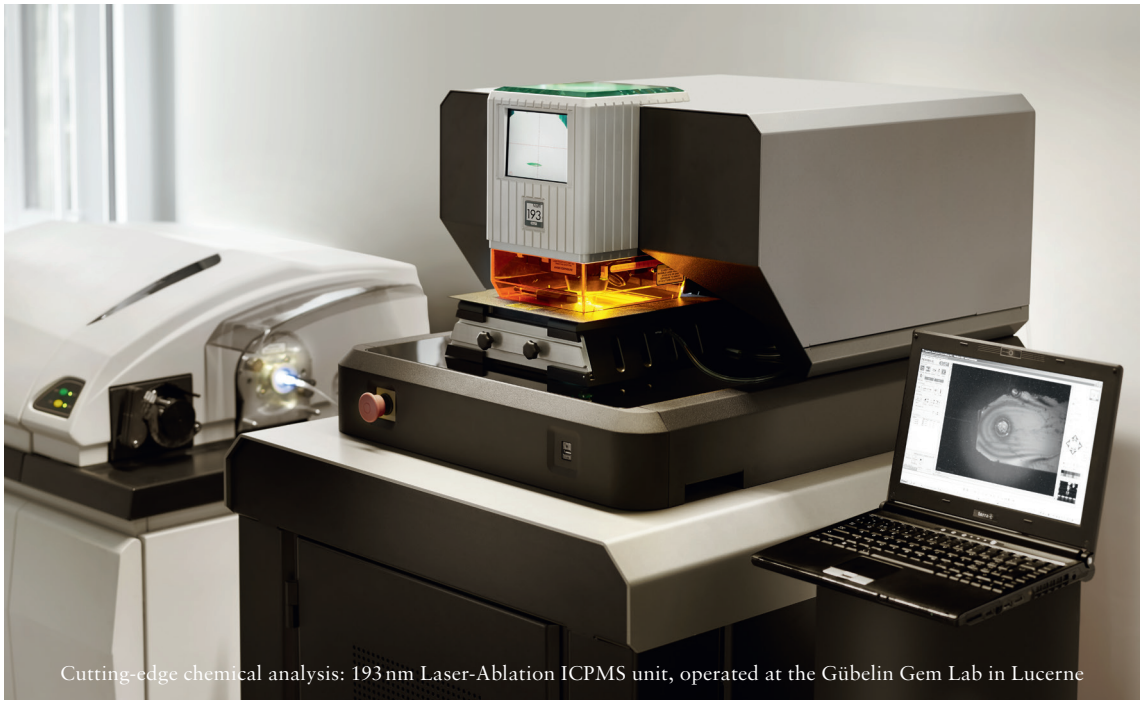
[4] The Gübelin World Ruby Reference is an empirical trace elemental composition of an assumed ruby with the averaged and weighted concentration of potentially indicative elements, comprising all commercially relevant deposits worldwide.



Trace element pattern for the 15.68 ct Colombian emerald, gathered by energy dispersive X-ray fluorescence (ED-XRF) spectrometry. The blue line shows the deviations of a selection of trace element concentrations in comparison to the normalised Gübelin World Emerald Reference, shown in red.



Multi-phase inclusion, typically found in Colombian emeralds



Cutting-edge chemical analysis: 193 nm Laser-Ablation ICPMS unit, operated at the Gübelin Gem Lab in Lucerne

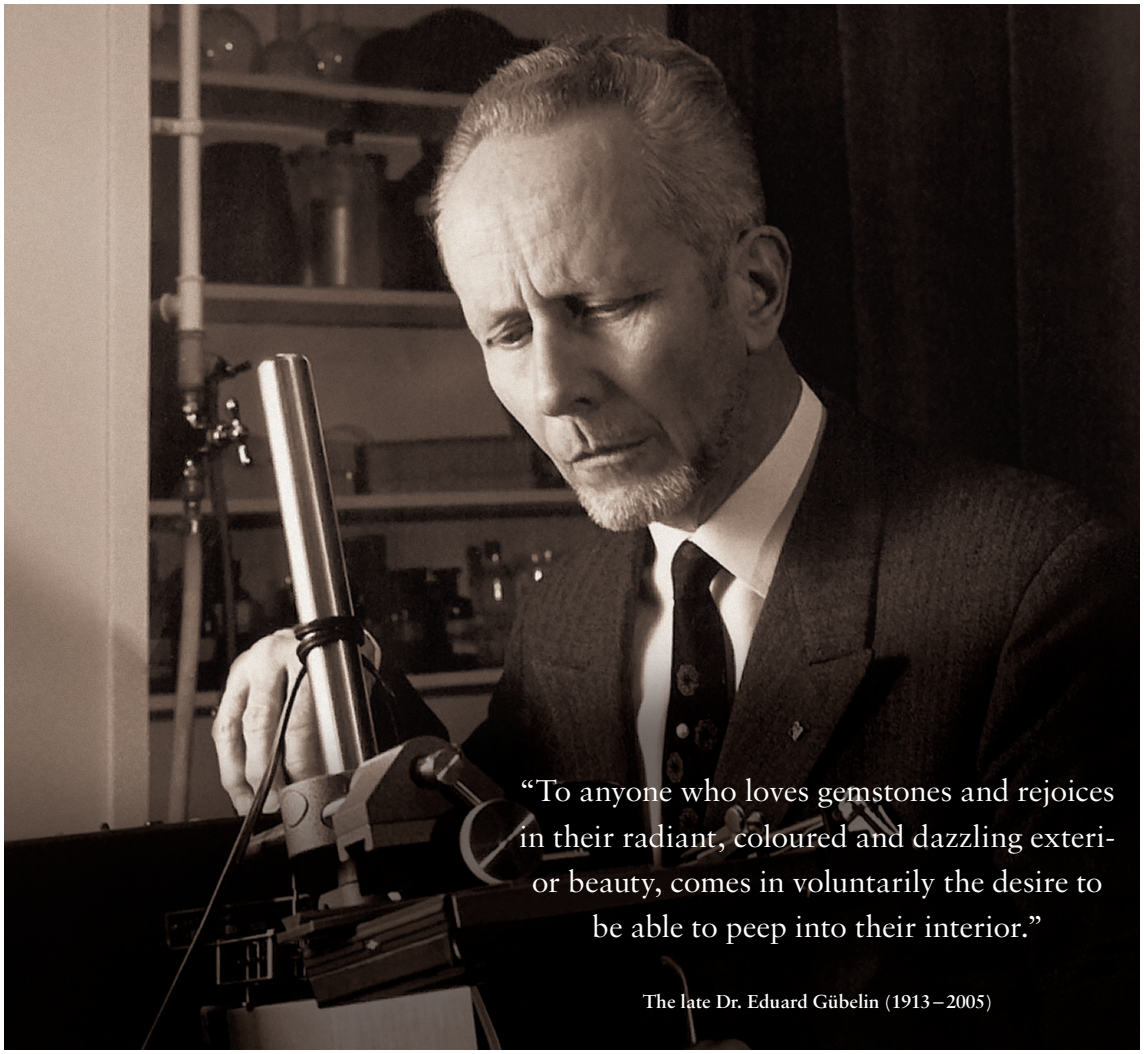
Spectroscopic features

Different methods of spectrometry are applied to help determining the origin and possible treatments of a gemstone. These analytical techniques apply electromagnetic radiation that interacts with the gemstone, providing information about its chemical and structural constituents (i.e. elements, molecules, crystallographic properties) through the characteristic absorbance of visible, infrared and/or ultraviolet light.

Spectroscopy applying ultraviolet to visible light is an essential technology to distinguish Colombian emeralds from those from other deposits showing similar three-phase fluid inclusions. The present 15.68 ct emerald shows spectroscopic features typical for emeralds low in iron, such as those from Colombia.

ABOUT GÜBELIN GEM LAB

The roots of the Gübelin Gem Lab go back to the 1920s. The laboratory's standard of excellence and tireless devotion to the science of gemmology, pioneered by the late Dr. Eduard Gübelin, soon came to be rewarded with international esteem and recognition. Today, the team of the Gübelin Gem Lab is composed of highly trained and experienced professionals who share a passion for the treasures released by the earth and entrusted to our hands by our clients. We combine state-of-the-art analytical techniques, expertise and extensive practical skills when it comes to interpreting gemmological and geological data and rendering a professional opinion on diamonds, coloured stones and pearls. We are committed to maintain the integrity and reliable service that our clients have come to expect from the Gübelin Gem Lab.



ADDENDUM

References

Deer W.A, Howie R.A, Zussman J, 1992
An Introduction to the Rock-Forming Minerals, 2nd edition
Longman Scientific & Technical, Essex

Giuliani, G., Chaussidon M., Schubnel, H.J, Piat, D.H, Rollion-Bard, C., France-Lanord, C., Giard, D., de Narvaez, D. & Rondeau B.
'Oxygen Isotopes and Emerald Trade Routes Since Antiquity'
Science, , Vol. 287, no. 5453,
Jan 2000, pp. 631-633

Groat Lee A., 2014 (editor)
Geology of gem deposits, 2nd edition
Mineralogical Association of Canada, Short Course Series
Vol. 44, Vancouver

Gübelin Eduard J, Koivula John I, 1986
Photoatlas of Inclusions in Gemstones, Vol. 1
ABC, Zürich

Gübelin Eduard J, Koivula John I, 2008
Photoatlas of Inclusions in Gemstones, Vol. 3
Opinio, Basel

Gübelin Gem Lab, 2012
GemPortrait for a Colombian emerald

Gordon, Robert, 1888
'On the Ruby Mines near Mogok, Burma'
in Proceedings of the Royal Geographic Society and Monthly Record of Geography

Hughes Richard W, 1992
Ruby & Sapphire,
RWH Publishing, Boulder

Morgan, D. 2007
'From Satan's Crown to the Holy Grail: Emeralds in Myth, Magic and History'
Praeger

Pogue, Joseph E, 1917
'The Emerald Deposits of Muzo, Colombia
Transactions of the American Institute of Mining Engineers, Vol. LV

Ringsrud, R., 2009
'Emeralds A Passionate Guide: The Emeralds, the People, their Secrets'
Green View Press

Sinkankas, J, 1981
'Emerald and Other Beryls'
Chilton Book Company; 1st edition

Streeter, Edwin W, 1898
'Precious Stones and Gems, Their History, Sources and Characteristics'
Estes & Lauriat

Gübelin Gem Lab Ltd.
Lucerne
Maihofstrasse 102
6006 Lucerne, Switzerland
T: +41 41 429 17 17
F: +41 41 429 17 34
info@gubelingemlab.com

Gubelin Gem Lab Ltd.
Hong Kong
Room 1005, 10/F,
China Building
29 Queen's Road Central,
Central, Hong Kong
T: +852 2868 2781
F: +852 2868 2791
hkg@gubelingemlab.com

Gubelin Gem Lab Ltd.
New York
608 Fifth Avenue, Suite 806
New York, NY 10020, USA
T: +1 212 956 0428
F: +1 212 956 0429
ny@gubelingemlab.com
www.gubelingemlab.com

Gübelin Academy

Gübelin Academy was established in 2013 to offer unique, fast-track training into the wonderful world of coloured gems. Designed for professionals as well as enthusiasts and connoisseurs, courses cover the basics as well as the advanced history, gemmology and psychology behind the most precious and colourful commodities in the world.

Gübelin Academy
Room 3405-3406, 34/F
Gloucester Tower,
The Landmark
15 Queen's Road, Central,
Hong Kong
T: +852 2264 6898
F: +852 2440 4040
info@gubelinacademy.com
www.gubelinacademy.com