GEMMOLOGICAL PROFILE

GÜBELIN

FOR A

COLOMBIAN EMERALD

OF

2.08 CT

COMPLEMENTING

GEMMOLOGICAL REPORT
NO. 17010073

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.

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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. 17010073, contained in the inside cover page of this booklet. In this Profile, we present our insights and findings for the 2.08 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 January 17, 2017, the Gübelin Gem Lab in Lucerne has been entrusted with testing the 2.08 ct gemstone presented here. The careful assessment and detailed analytical studies performed on this gemstone revealed the results provided in the Gemmological Report No. 17010073 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 www.gubelinacademy.com

To the ancient Egyptians,
emeralds symbolise
youth, life and rebirth

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 and resulting in a final weight of 2.08 ct for this stone[ACA].

SHAPE AND 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 pleo-

chroism[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 8.27 mm in length, 7.72 mm in width and 5.19 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

The single 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 a saturated and homogeneous green colour, free of any overtone.

TRANSPARENCY

In emeralds, the transparency and clarity are quality treats equally 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 2.08 ct emerald presented here is very slightly included, having only a minute effect on the appearance of the stone.

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.

Only a very small number of emeralds are spared from this natural process. Thus, emeralds with only very minute fissures or no fissures at all are very rare. Those specimens are immune to the type of treatment (see also the chapter on treatment further below) most emeralds are subjected to, i.e. filling the fissures with a foreign substance such as oil, resin or wax, to mask the fissures. The present 2.08 ct emerald is an example of such a rarity, showing virtually no eye-visible fissures.

IDENTITY AND ATHENTICITY

One most fundamental information any gem lab report has to provide is on 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 emerald. 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 2.08 ct gemstone has proven to be of the green variety of natural beryl, called emerald.

OVERALL QUALITY ASSESSMENT

The 2.08 ct emerald described in Gübelin Gemmological Report No. 17010073 is of very high visual quality. Only a small share of the emeralds coming out of a mine is of this level of quality and hence considered rare.

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 2.08 ct emerald has been determined to be Colombia, known since more than five centuries as the prime provenance of emeralds[ACA].

Emerald mine, Muzo, Colombia

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 cultures 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 collected 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 rubies 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].

The intensivity of the green colour in fine emeralds enjoys an unparalleld reputation in the kingdom of gems

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.

Major emerald deposits

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].

This Colombian emerald grew some 30 to 38 million years ago

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 2.08 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.

Multi-phase inclusion, typically found in Colombian emeralds

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 2.08 ct emerald, the scientists in the Gübelin Gem Lab have scrutinised its microscopic features, analysed its detailed chemical composition and its physical-structural properties.

MICROSCOPIC FEATURES

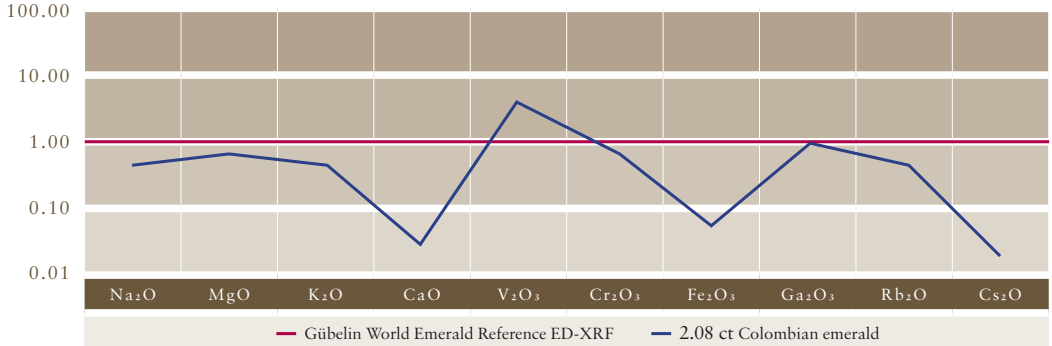
In combination with the magnifying aid of a microscope, the experienced human eye provides an extremely sensitive, powerful and versatile analytical tool. The determination and description of the microscopic characteristics found in a gem - ranging from tiny crystals, fluid inclusions, and particles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

Some fractures may heal during the formation of an emerald. During the the healing process liquid is often trapped inside the stone as seen in this 2.08 ct Colombian emerald.

Some of the internal features recorded in this emerald include three-phase fluid inclusions with a jagged outline and straight growth structures. These inclusions are regularly observed in Colombian emeralds and are potentially helpful indicators to determine their authenticity and origin[2].

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.

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



Trace element pattern for the 2.08 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.

CHEMICAL FEATURES

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.

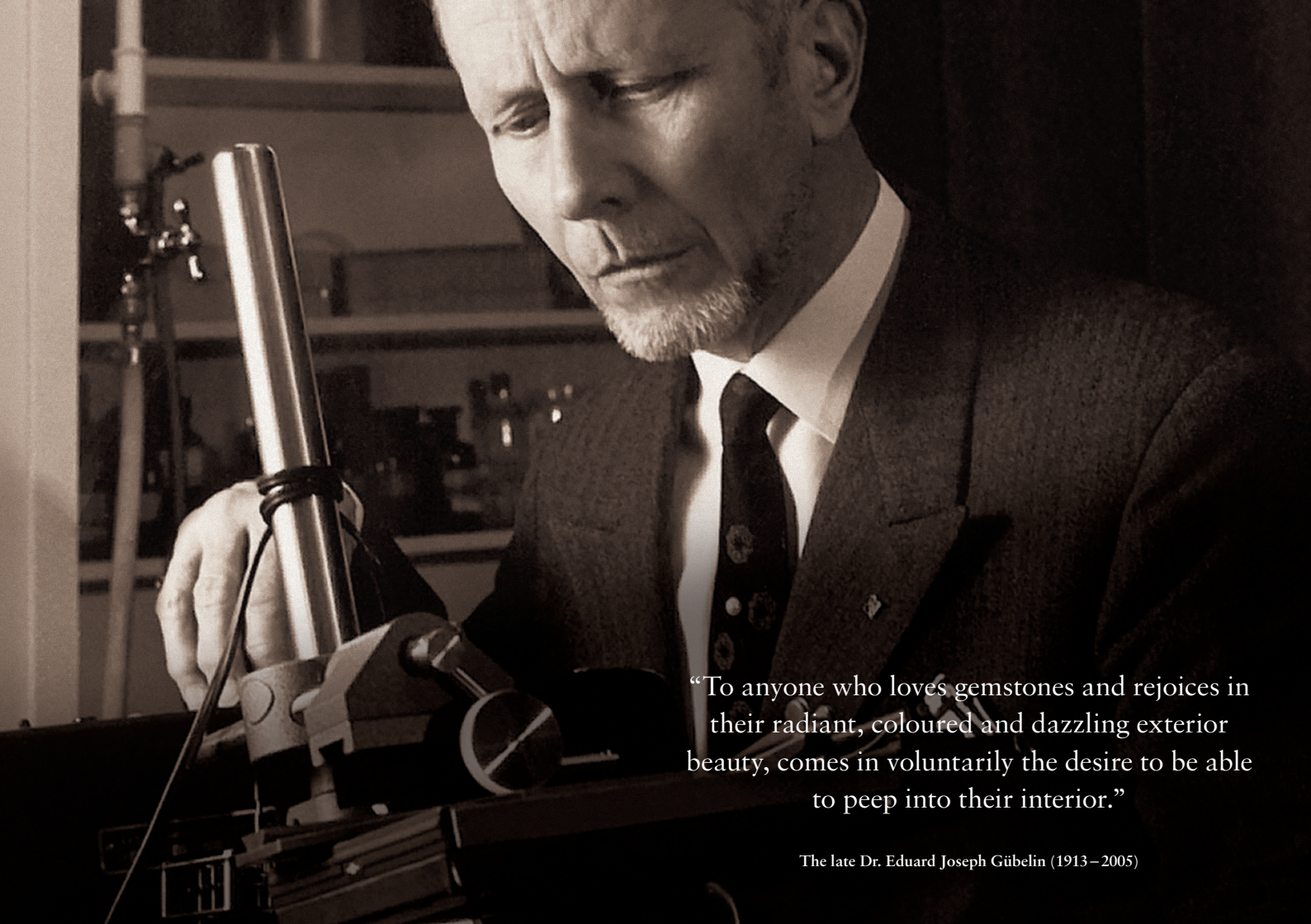
3 For more information about the applied analytical methods see gubelingemlab.com

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 2.08 ct emerald shows spectroscopic features typical for emeralds low in iron, such as those from Colombia.

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



"To anyone who loves gemstones and rejoices in their radiant, coloured and dazzling exterior beauty, comes in voluntarily the desire to be able to peep into their interior."

The late Dr. Eduard Joseph Gübelin (1913 – 2005)

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

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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.

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