Bellerophon | Gemlab

« Esperança Da Serra »

Gemmological Report No. A13896

Privilege No. 163

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- PREFACE

Coloured gemstone

"The first objects that we picked up and said this has value for no other reason, it is not a food, not a fuel, not a medicine, it has value purely because of its beauty, these were Coloured Gems".

_ Author Unknown

INTRODUCTION

Gemstone has fascinated the human mind since the dawn of time. They have inspired myths, curses, and have been worn by the greatest kings and emperors who often owned the finest gems.

All the gemstones we so greatly treasure and admire come from various depths and locations in the earth's crust.

People have treasured gems for many reasons throughout history. Some of these reasons include the use of gems as beautiful decorative ornaments, religious symbols, good-luck charms, and medicinal purposes. Mainly however, gemstones have been used to display wealth, status, and power.

The Egyptians and later the Romans were among the first to celebrate the power of gemstones. For example, Cleopatra was known for her love of emeralds, which were believed to possess powers of clairvoyance and to defeat spells and enchantments.

T. Rozet

EXAMINATION RESULTS

A Magnificent Emerald

- “These gems have life in them: their colors speak,
say what words fail of”

_ George Eliot

On November 4th, 2024, Bellerophon Gemlab meticulously scrutinized natural emeralds on matrix, as documented in Report No. A13896.

These gemstones, of remarkable allure, warrants distinguished recognition.

The emeralds are boasting a translucent clarity, and are masterfully crafted by nature into distinct rough octagonal shapes. With a substantial weight of 19.15 kilo, they display a captivating intense green hue.

During examination, minimal microscopic internal features were detected, alongside a harmonious blend of trace elements characteristic of emerald sourced from the esteemed Brazil region.

Rare in both size and quality, the possession of such natural emeralds in matrix is a singular privilege.

IMAGE IS APPROXIMATE IN SIZE AND COLOUR

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PRIVILEGE GEMMOLOGICAL REPORT

Report Number:	A13896
Date:	04 November 2024
Weight:	19.15 Kg
Measurements:	40 x 30 x 16 cm
Shape:	Rough
Identification:	Natural Emeralds
Colour:	Intense Green
Comment:	Minor amount of clarity modification
Origin:	Brazil

M.P.H. Curti *T. Rozet*

EMERALD

$Be_3 Al_2[Si_6O_{18}]$ + Cr, V, Fe, Mn, Mg, Na, Cs, Rb, Li, ...

-“ Emerald is a transparent bright green chromium-rich variety of beryl.”

Emerald - a member of the beryl family - is a beryllium-aluminium-silicate built of ring-shaped units. The crystal structure shows a channel-like arrangement of silicon-oxygen ring units along the c-axis.

These structural channels play an essential role in incorporating those ions that do not necessarily fit into the beryl lattice.

Beryl is an allochromatic mineral; chemically pure beryl is colourless. The colour range of beryl varieties is determined by those foreign elements that are built into the lattice. The most important of these are iron (for blue, green, and yellow), manganese (for pink and red), chromium and vanadium (both for green).

The dominant colorant of most emeralds is chromium though almost identical colour shades are produced by vanadium.

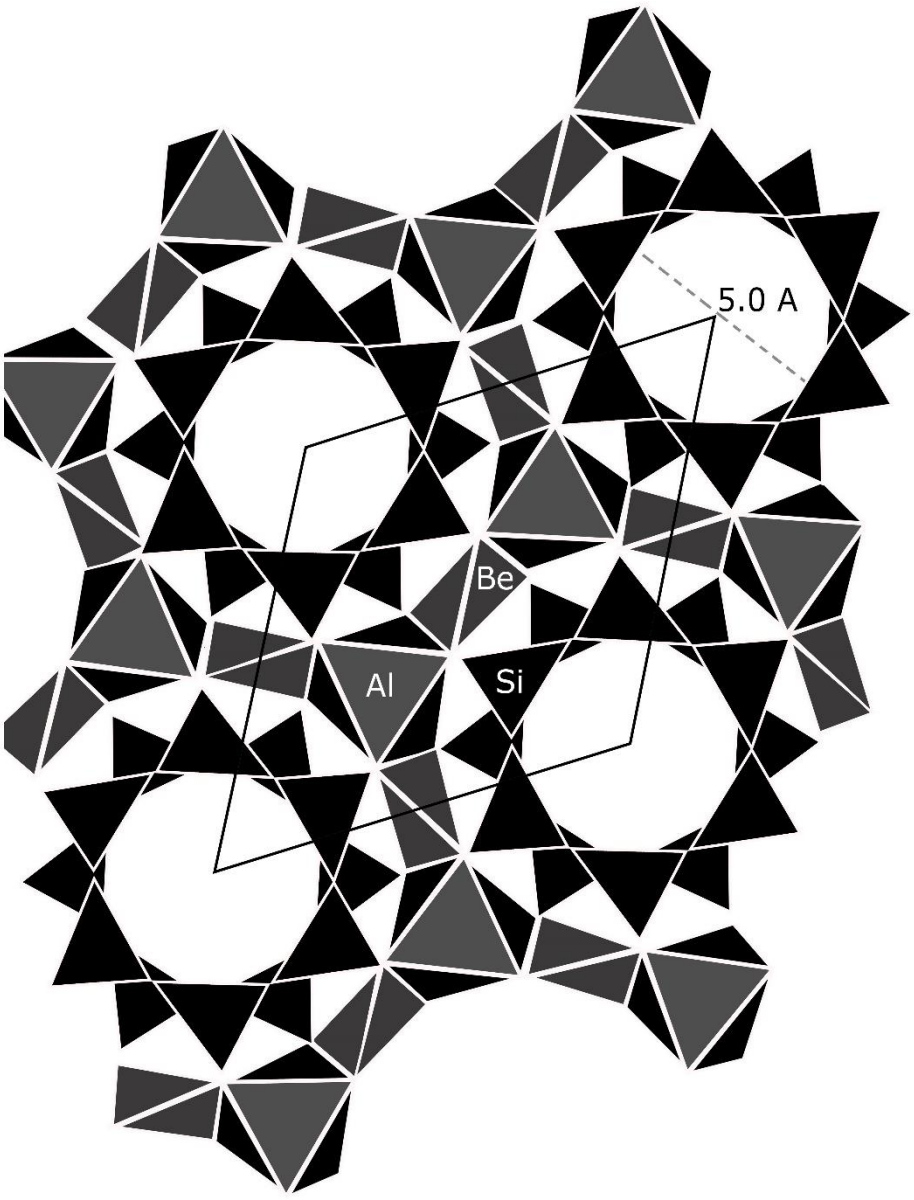

Figure I1 **CRYSTAL STRUCTURE OF BERYL**
(001) PLANE

HISTORY & LEGEND

Emerald has excited imaginations since antiquity. Its name comes from the ancient Greek word for green, "*Σμάραγδος*" "smaragdus." Pliny the Elder described emerald in his Natural History, published in the first century AD: "…nothing greens greener".

The first known emerald mines were in Egypt, dating from at least 330 BC, Cleopatra was known to have a passion for emerald, and used it in her royal adornments.

Emeralds from South America were part of the plunder when sixteenth-century Spanish explorers invaded the New World. The Incas had already been using emeralds in their jewellery and religious ceremonies for 500 years.

Legends endowed the wearer with the ability to foresee the future when emerald was placed under the tongue, as well as to reveal truth and be protected against evil spells. Emerald was once also believed to cure diseases like cholera and malaria. Wearing an emerald was believed to reveal the truth or falseness of a lover's oath as well as make one an eloquent speaker. (gia.edu/emerald-history-lore)

Legend also states that emerald was one of the four precious stones given by God to King Solomon. These four stones were said to have endowed the king with power over all creation.

GEOLOGICAL-GENETIC CONSIDERATIONS

- “The beginning is the most important part of the work”

_ Plato

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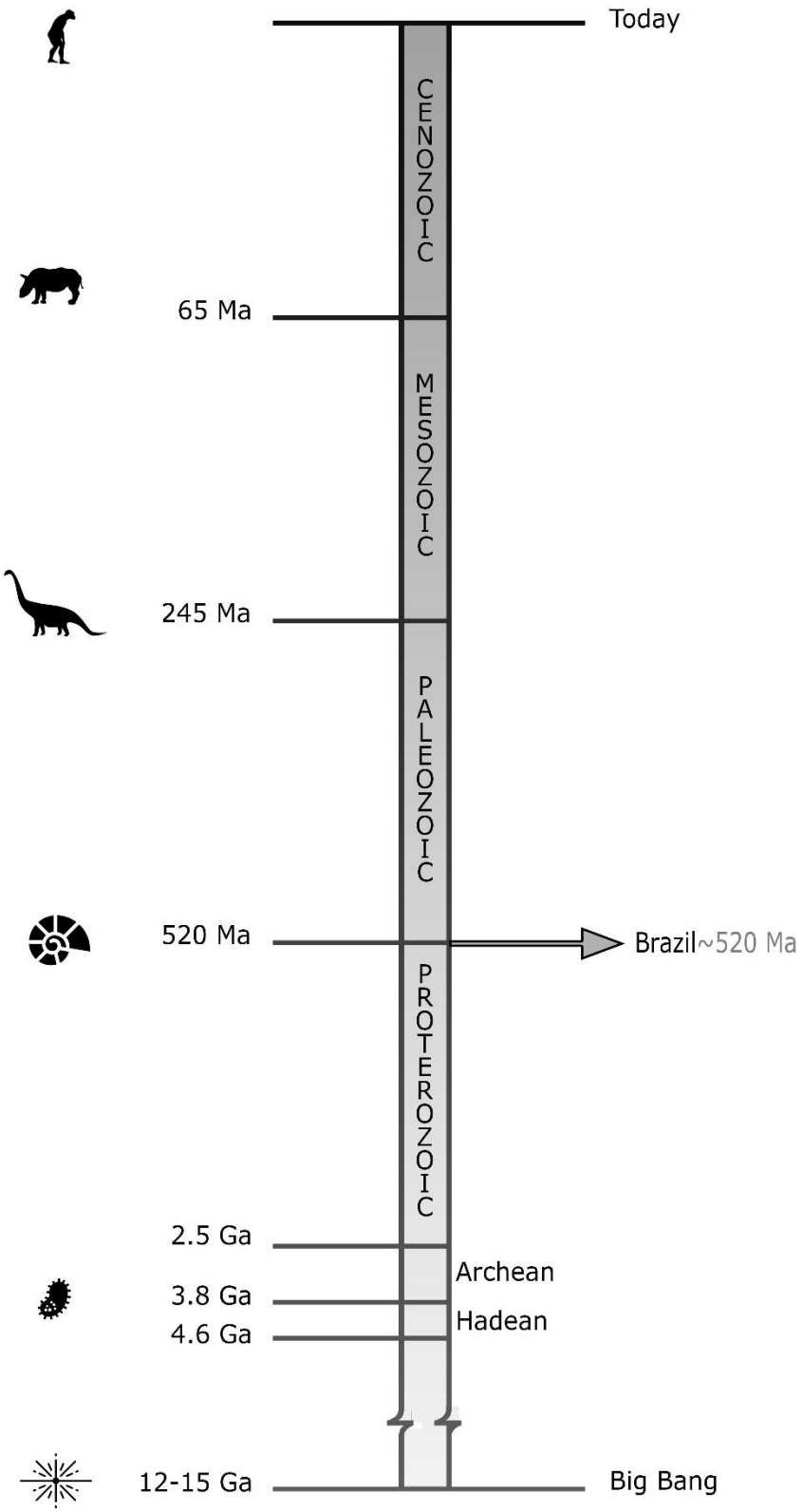
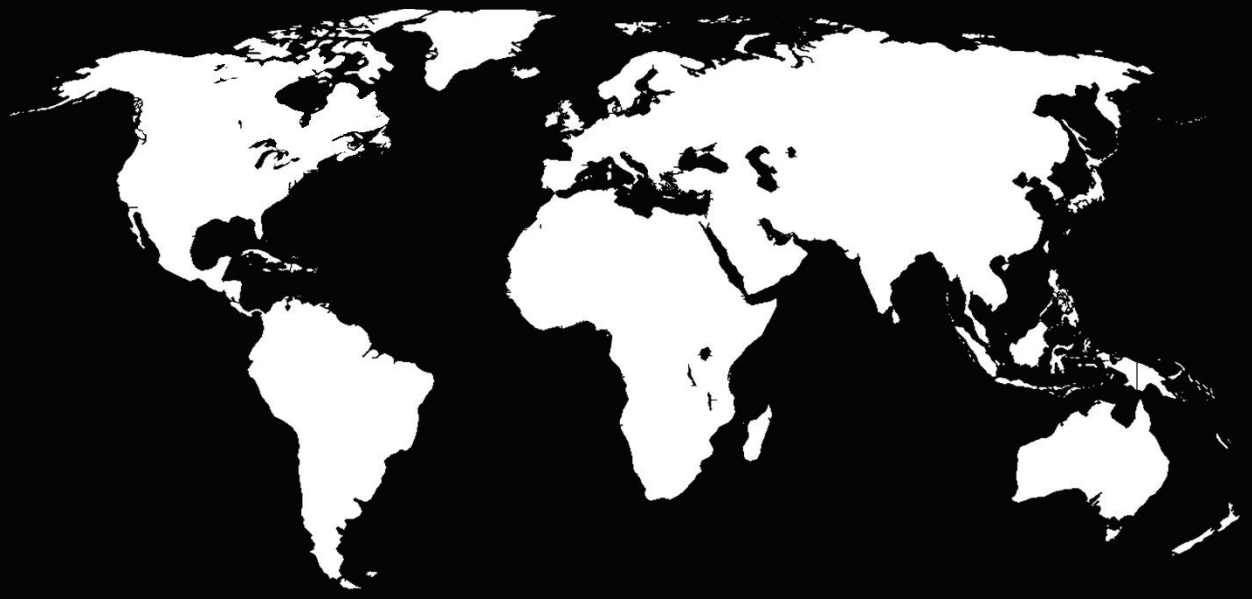
Estimation age for Emerald mineralisation in Brazil.



200 MILLION YEARS AGO

TODAY



The emerald mines of Bahia, Brazil, hold a captivating history rooted in the northeastern state's diverse terrain and mineral wealth. Bahia, the fifth-largest state in Brazil, features landscapes ranging from coastal plains to mountainous plateaus.

While Bahia is known for rich deposits of gold, iron, bauxite, and manganese, it is the emeralds of Carnaíba and Socotó that add a unique gemmological allure. The discovery of emeralds in Bahia traces back to early 20th-century records, though the first substantial mining activity began only in 1963.

These emeralds, found within the mountainous terrain of Campo Formoso and Pindobaçu, about 400 kilometres from Salvador, Bahia’s capital, are known for their distinctive green hues. The Socotó emeralds, in particular, were discovered by accident in 1983 in Campo Formoso, approximately 50 kilometres northeast of Carnaíba.

Prior to this, traces of emerald mineralization had been observed within the serpentine rocks of the Campo Formoso granite batholith. Today, these mines are less actively exploited, and Bahia's emeralds have become rare treasures in the global market, prized for their unique coloration and historical significance.

VIVID GREEN

EMERALD

- All gemstones are gifts of nature.

Colour has the greatest influence on an emerald's value, and preferred emerald have strong to vivid colour saturation.

The most valued green is vivid green to intense bluish green, in medium to medium-dark tones.

ANALYTICAL PROPERTIES

“ I am among those who think that science has great beauty”

_ Marie Curie

The testing of a coloured gemstone at Bellerophon laboratory involves the full range of analytical methods. Some are traditional such as measuring the refractive index and specific gravity. Others involve state-of-the-art testing such as spectroscopy and laser induced break down spectroscopy. Together, the combined techniques give a deep understanding of the gemstone properties.

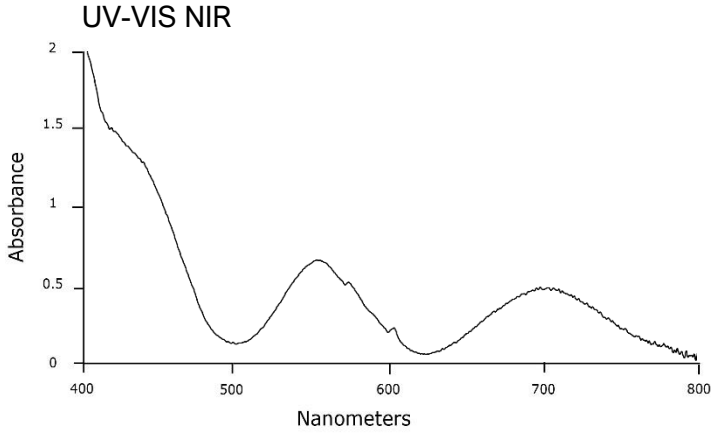
The present gemstone was studied with all available instrumentation by a team of experienced gemmologists. Their combined observation and data interpretation are detailed in the following pages.

From these data: the chemical fingerprinting, and the spectral fingerprinting in the UV-vis-NIR region and the vibrational fingerprinting (Raman and FTIR range), are the most valuable characteristics for the “gemmological interpretation” of gemstone. The chemical fingerprinting is made using E.D.X.R.F (energy dispersive X-ray fluorescence) and L.I.B.S. (laser induced breakdown plasma spectrometry).

Spectral fingerprinting – UV-vis-NIR

Absorption spectra reveal which portions of light are absorbed by the gemstone and which are contained in the transmitted light. It is the type and quantity of foreign elements that determine how much and which light wavelengths are absorbed.

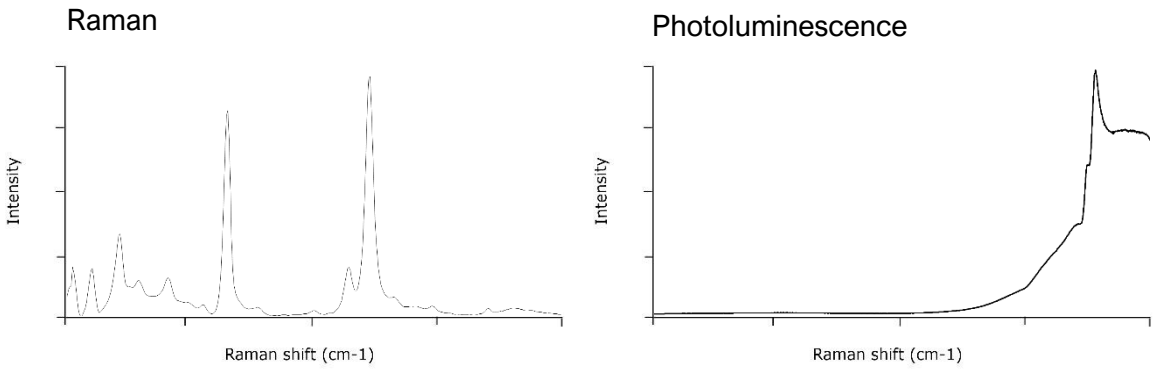
Ultraviolet Visible Near Infrared absorption spectroscopy is a complementary technique to EDXRF for examining chemistry because trace element chemistry controls colour in the gemstone providing information about the colour inducing element it contains.



Raman Spectroscopy

Raman spectroscopy is a non-destructive vibrational spectroscopy. A typical Raman instrument consists of a classical microscope with either, transmitted or reflected light, a low-power laser excitation source, the spectrometer for high resolution light analysis and an appropriate computer for data collection and analysis.

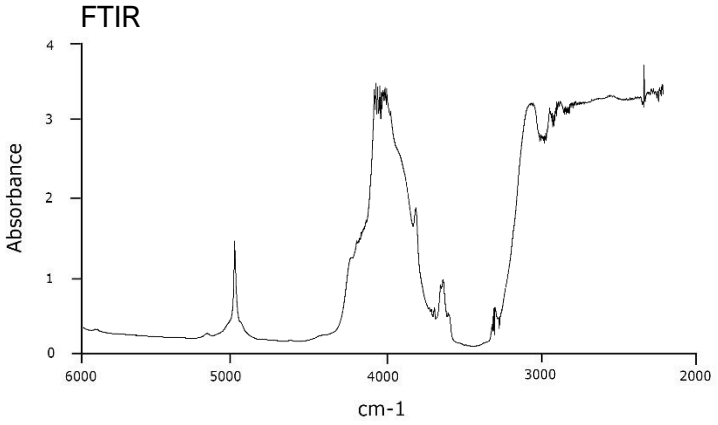
Raman spectrometers are useful for rapidly identifying gemstones since most materials produce characteristic Raman spectra. Most Raman spectrometers can measure photoluminescence as well as Raman scattering.



Infrared spectroscopy

In the infrared, spectral features generally arise from vibrations of molecular and structural components of the crystal. For example, carbon in diamond and water when present in a gemstone, have characteristic signals in the infrared.

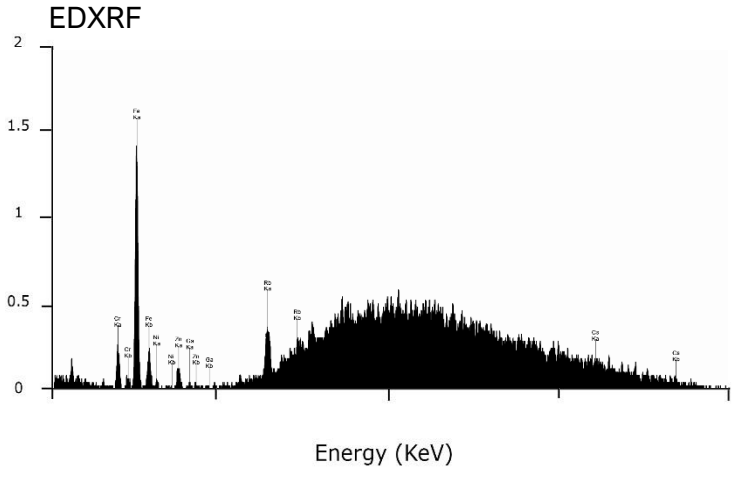
Infrared spectra can be used to help separate one gem material from another or to detect certain types of treatments. The infrared region of the electromagnetic spectrum is the energy range just beyond the red end of the visible spectrum. The unit by which infrared energy is usually measured is the wavenumber (number of waves per centimetre), which is expressed in reciprocal centimetres (cm-1) (Stockton, 1987).

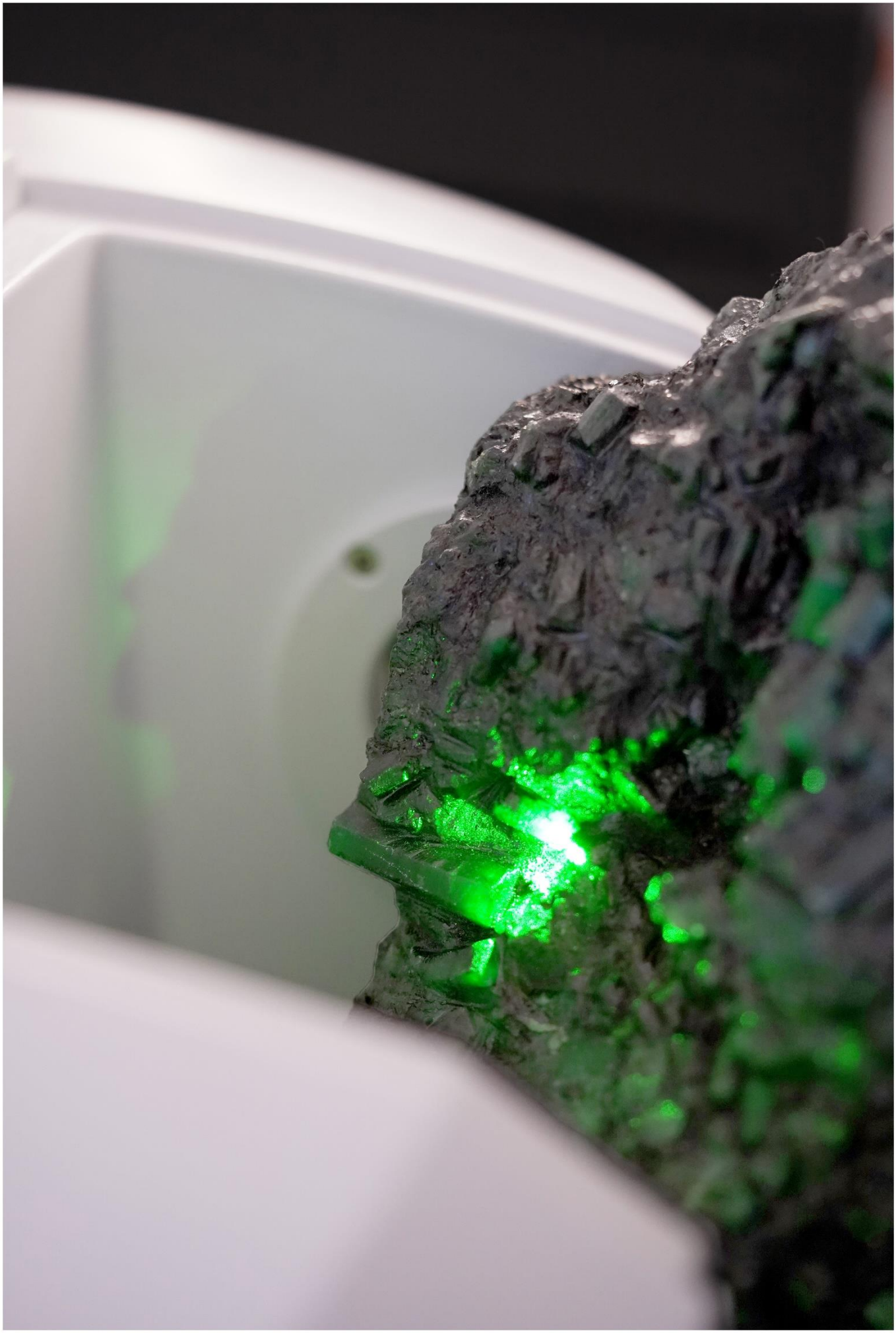


Chemical fingerprinting

The chemical fingerprint of an emerald reflects the geological-mineralogical environment (composition of mineralizing fluids, host rock composition, temperature, and pressure conditions) at the time of its formation.

It is the contents and the ratios of the relevant elements (e.g., chromium, vanadium, iron, scandium, and cesium) that define the chemical fingerprinting of emerald from different geographic origins and/or from different geologic-genetic environments.





INTERNAL FEATURES

- Every gemstone is a reflection of its inner world.

The gemmological microscope is widely considered one of the most useful equipment in a gemmological laboratory. With high quality microscope and multiple illumination techniques, an experienced gemmologist can make detailed observations and highly accurate assessments.

Among the properties used for the characterization of coloured gemstones, the interpretation of the internal features is - in general - still the most common and most important routine examination for the gemmologist at Bellerophon laboratory.

The precise description and the identification of emeralds inclusions is an important tool in distinguishing between genuine and synthetic emerald as well as in determining the geographic origin of natural emerald. Study and documentation of the inclusion phenomena in the gemmological microscope are essential and an integral part of the testing procedures of a coloured gemstone.

SHAPE & CUT

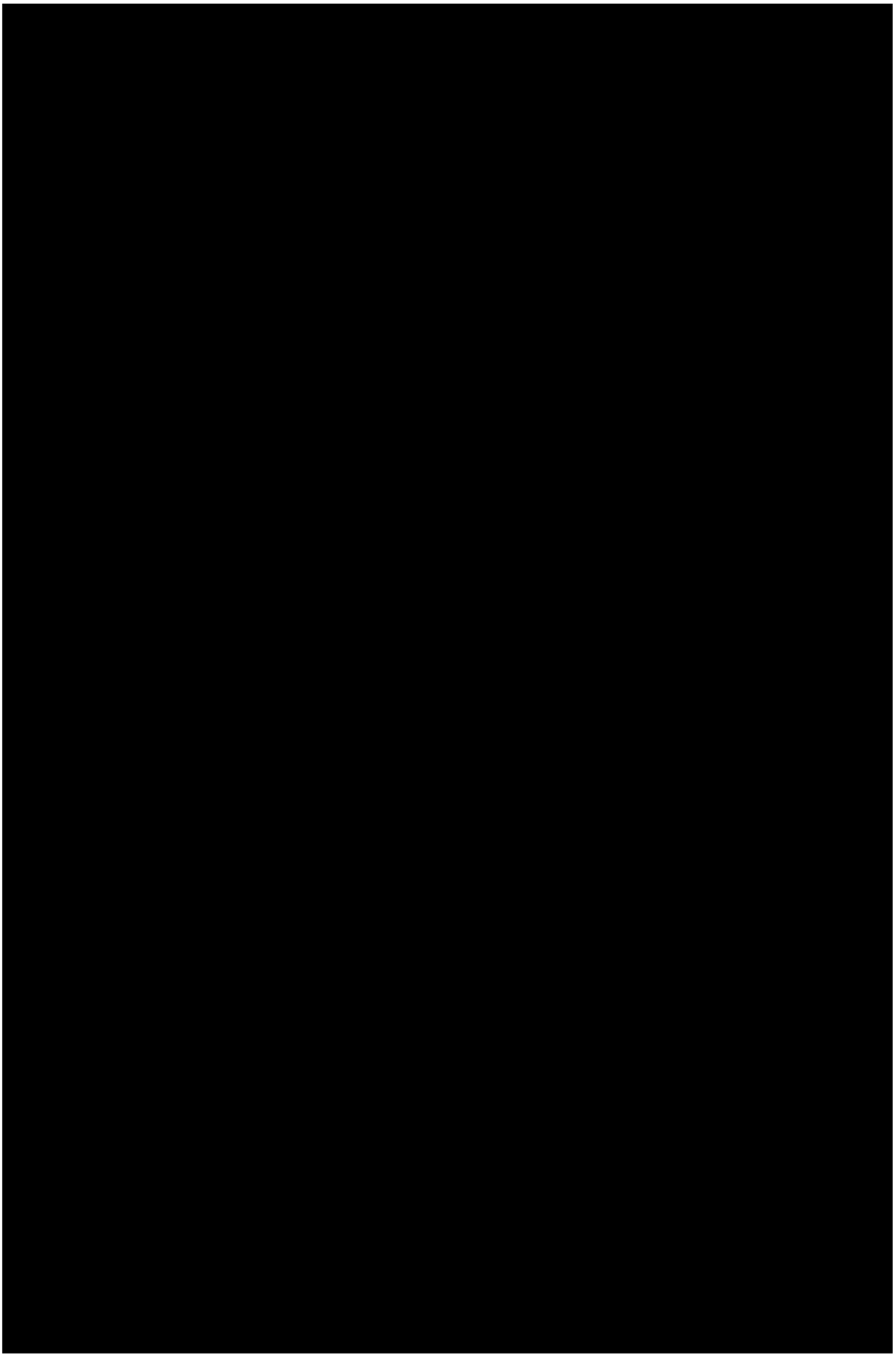
- “The cutting of a gem has to be finished before you can see whether it shines.”

_ Leonard Cohen

Cutting rough emerald present numerous challenges. The colour of the stone can be uneven so the master cutter must choose an orientation in which the finished stone will have an even face-up colour. emerald is pleochroic, meaning its overall colour is changing depending on the crystal axis.

The present gemstone displays a particularly good brilliancy and good proportions. Achieved through skilful cutting of this emerald.

The degree of lapidary craftsmanship adds value to the nature of this emerald and contributes to the well-pronounced colour.



Bellerophon | Gemlab

We are an independent gemmological laboratory created for you to serve you in the attempt to comprehend and grasp the truth in this fascinating and multi facets world named "Gemmology".

We prefer to think of ourselves as more than just a gemmological laboratory. We are pioneers in new frontier where higher standards, transparency, and integrity meet.

With our head office in Paris, France and a full state-of-the art laboratory in Bangkok, Thailand, we are actively creating opportunity to further increase quality and set higher standard in our industry.

- Independent gemmological laboratory
- State of the art technology
- Highly qualified gemmologists
- Complete reference collection
- Unique combination of expertise
- Expert system / Artificial intelligence assisted
- Complete transparency

Technology

Bellerophon's R&D department harnessed thanks to successful partnership with leaders in other fields such as Artificial intelligence, Photography, Optics, Luminescence Spectroscopy, IT and Engineering new opportunities to better serve our customer worldwide and create a paragon of excellence.

Our research centre is equipped with state of the art heating furnaces and cutting facility, used for research and development for authentication of enhancement and research on origin determination only.

- Raman spectroscopy
- Photoluminescence spectroscopy (365nm, 532nm & 708nm)
- Ultraviolet visible near infrared spectroscopy
- Fourier transform infrared spectroscopy
- Energy dispersive X-ray fluorescence
- Laser-induced breakdown spectroscopy
- Ultraviolet imaging
- Refractometer
- Geiger counter
- Polariscope
- 3D scan system
- Keyence microscope

Knowledge

Director | **M.P.H Curti**

M.P.H Curti, Graduate Gemmologist is the director of Bellerophon since august 2018. Started his career as a gemstone cutter in Burma (Myanmar). Worked in Mozambique with Gemfields. Later traveling to many gems deposit and gem centers in Asia, Africa, Europe, and America. Assisted with the discovery of a new mineral, worked with GRS, Thailand, and featured in a GIA article about the discovery of a new gem deposit.

Managing Partner & Gemmologist | **T.Rozet**

T.Rozet, Advanced Training Course from SSEF and Gemmologist from Gem-A (GA) is the Bangkok Managing Partner of Bellerophon Gemlab BOI. Successfully finished the intense gemmological program with a detailed approach to identifying treatment and origin of ruby, sapphire, and emerald.

Research Associate | **Ferdin Joe J.J, PHD**

F.J.J Joseph, PHD is a lecturer in the Thai-Nichi institute of Technology, specialized in data science, with a P.H.D in computer Science and information System. He provides us with reliable system for data processing and comparative analysis.

Research Analyst & Junior Gemmologist | **H.P. Ellia**

H.P. Ellia is the research analyst, a dedicated member of our team with a specialty in analytical operation. He operates instruments such as EDXRF and Raman spectroscope. He provides gemmologists with the required data collection, and study gemmology.

Laboratory Manager & Gemmologist | **E. Marlin**

E. Marlin is the Laboratory manager and a Gemmologist of Paris, holder of the FGA diploma, worked for Cartier Paris, she is a dedicated member of our team with a specialty in analytical operation. She interprets data on instruments such as FTIR and Raman micro spectroscopy.

Gemmologist | **Dr.G. Musilli**

G. Musilli is a doctor in Earth Science, with specialization in Crystallography, Petrography and Mineralogy from the University of Milan coupled with a bachelor in Geoscience from the University of Turin. Her thesis on Ethiopian Emerald received the best year thesis award "Ernesto Fea". She is currently a Junior gemmologist in the Paris team.

Reference Collection

- Comparative analysis on one of the most complete databases in gemmology.

A reference collection of more than 9000 samples including most gemstones, all known synthetics made, all enhancement ever detected and more than 4000 gem-quality samples for origin determination for Spinel, Chrysoberyl, Opal, Emerald, Ruby & Sapphire. More than 30 countries of origin referenced.

- Identification: +600 minerals recorded
- Treatment: All treatments known for all major gemstone recorded
- Genesis: Collection of all beryl & corundum synthetic
- Origin determination: + 4000 samples for origin