GÜBELIN

GEMMOLOGICAL PROFILE

4.79 CT

BURMESE RUBY

COMPLEMENTING
GEMMOLOGICAL REPORT

No. Specimen 6

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.

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See also gubelingemlab.com.

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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 their 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 6, contained in the inside cover page of this booklet. In this Profile, we share with you our insights and findings for the 4.79 ct Burmese ruby, disclosing some of its microscopic, chemical and structural characteristics, and providing you with 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 24 April 2017, the Gübelin Gem Lab in Lucerne has been entrusted with testing the 4.79 ct gemstone shown above. The careful assessment and detailed analytical studies performed on this gemstone revealed the results provided in the Gemmological Report No. SPECIMEN 6 and are described in more detail in this Gemmological Profile.

HISTORY & SYMBOLISM OF RUBY

Above all others, ruby has historically been prized as the most precious and powerful gemstone in the world. Two names in Sanskrit hint at the stone's noble, indeed royal, charisma: 'Ratnaraj', 'king of the precious stones' and 'Ratnanayaka', 'leader of precious stones' [ACA].

The fiery life within the ruby was recognised in early Western tradition, as part of the nomenclature for all glowing red stones, but also as a property in its own right. A fourth century source noted the ruby's ability to shine in the dark, and through the material of clothing. This internal fire from within the gem engendered the later belief that the life of the ruby was linked to that of the person who owned it, giving the gem a prophetic quality. Ruby was used as a talisman that warns its bearer of danger by turning to a darker shade of red. A more contemporary association is that of enduring love. Ruby is still thought by some to be curative for all matters of the heart, both physical and emotional [ACA].

Unrivalled in colour, life and vitality for thousands of years from East to West, ruby has justly been named the king, the leader, the gem of gems.

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

DESCRIPTION

Weight

Geologic conditions under which rubies form are highly specific and rare. They grow in great depths in the earth crust, under extreme conditions of high pressures and temperatures. In this harsh regime, with a fierce competition for space, crystals grow at very small sizes only, rarely exceeding a few millimeters in diameter. The process of cutting and polishing further reduces the size of the crystal [ACA], and faceted rubies of good overall quality exceeding one carat in size are rare. Weighing 4.79 ct, the ruby presented here is a large specimen. It can generally be stated that increasing size in ruby seems to be inevitably linked to decreasing quality. For this reason, large perfect rubies are unheard of.

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 [ACA].

These considerations were also applied on the present crystal. It was fashioned into an octagonal shape, using the step cutting style. The dimensions of the gemstone are 10.91 mm in length, 8.49 mm in width and 5.80 mm in depth.

The cutting and polishing applied on this stone result in an attractive appearance of this ruby.

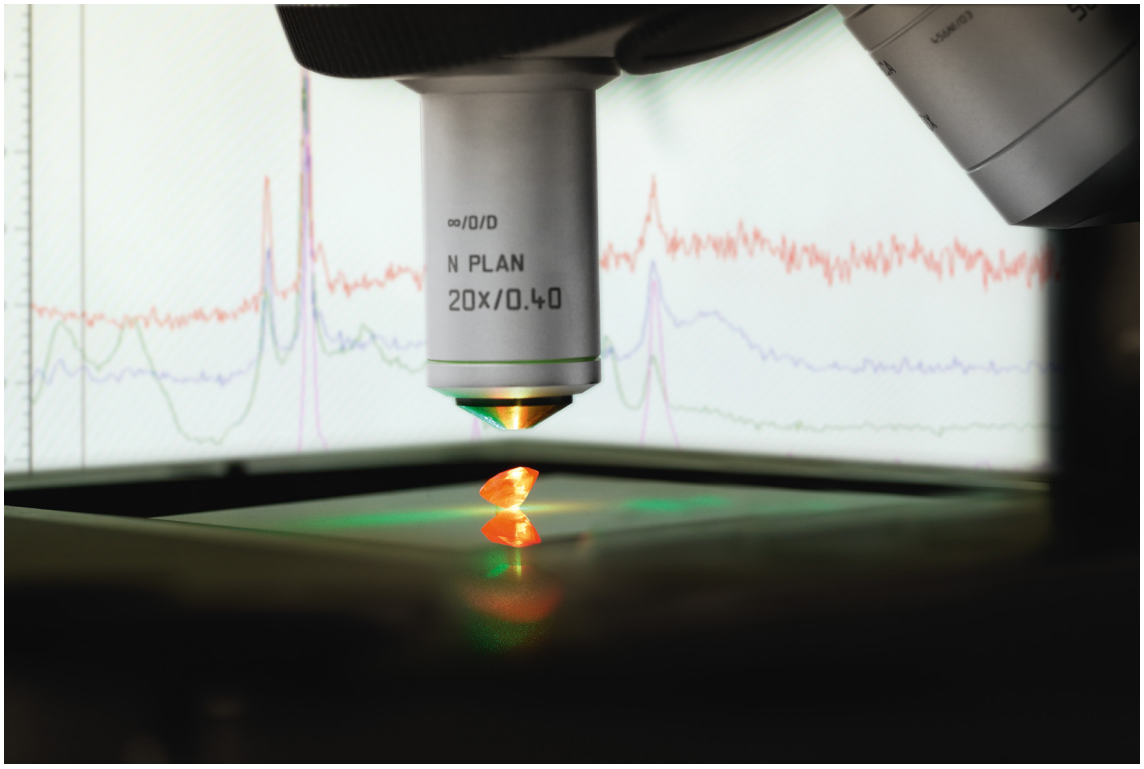
Colour & transparency
The single most important criterion of a gemstone's quality is its colour. In the case of rubies, the most coveted colour is a bright and pure red of high saturation [ACA]. This, however, is a rare gift granted to just a small share of all rubies. Most rubies show a colour slightly off the ideal colour; it might be slightly too dark, show a secondary hue of purple or orange, or might be undersaturated, the latter resulting in a pink rather than an intense red colour.

The colour of the present gem is very pleasant, characterised by an intense, saturated and homogenous red colour.

As a rule of thumb, the transparency of gemstones usually follows the same logic as in diamonds: the cleaner – i.e. showing no or few internal features only – the better. Although tiny, usually microscopically small inclusions are a common and welcome feature in coloured gemstones, ideally they do not affect the transparency of the stone.

This gemstone displays a very good transparency, with only a few minute inclusions, that do not affect the transparency of the ruby. Remarkably for a ruby, the stone shows virtually no eye-visible fissures.

Fluorescence – the inner glow
Some rubies seem to glow from within the stone. That fiery red inner glow is caused by an effect called



fluorescence, facilitated by a small amount of chromium in the atomic structure of ruby. Chromium atoms have the capability to absorb bits of the light of higher energy and emit a very specific red light in return, yielding a crimson glow that illuminates the stone and enhances its red body colour [ACA].

The ruby described herein displays a strong red fluorescence when exposed to ultraviolet light, enhancing the red body colour and adding to its appearance.

Identity & authenticity

One most fundamental information any gem lab report has to provide is the identity of the stone. Ruby is defined as crystalline aluminium oxide Al_2O_3, called corundum, with traces of the chemical element chromium, and sometimes vanadium. In gems, such trace elements are most commonly the agents responsible for adding colour. Despite their small contribution to the overall chemical composition of the gemstone, trace elements play a key role in determining whether a mineral is just a standard stone or a rare and coveted gemstone. Merely by replacing a few aluminum ions in the atomic structure of corundum with chromium ions, common, colourless corundum gets turned into a ruby of an attractive red colour [ACA].

With a hardness of 9 on the Mohs scale, corundum is one of the world's hardest minerals. This property, paired with toughness and durability, makes ruby and sapphire quite forgiving gemstones, keeping their beauty for many generations. Different types of minerals and other materials might be used to fake ruby, i.e. act as so-called simulants. Clearly, the value of a simulant is a fraction only of the true ruby. As ruby can also be grown synthetically, the authenticity needs be addressed; is the ruby indeed of natural provenance, i.e. grown millions of years ago in the depth of the earth, or is it a synthetic ruby, i.e. a man-made crystal? Synthetic rubies are

known for more than a hundred years, and possess chemical and physical properties almost identical to natural rubies. But the production and hence the supply of synthetic rubies is virtually unlimited, which reduces their value dramatically compared to a pristine, naturally grown ruby.

The 4.79 ct faceted gemstone has proven to be of the red variety of natural corundum, called ruby.

Overall quality assessment

The 4.79 ct ruby described in Gübelin Gem Lab Gemmological Report No. SPECIMEN 6 is of very high visual quality. Only very few gems coming out of a mine are gifted with such outstanding characteristics. A combination of quality traits as seen in the 4.79 ct ruby presented here is rarely found in natural, untreated Burmese rubies of this size.

Dawn over Burmese landscape

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, combined with a relatively steady production over decades or even centuries, have contributed greatly to the reputation of a few specific gem deposits.

The country of origin of the present 4.79 ct ruby has been determined to be Burma, known since early medieval times as the provenance of the best rubies worldwide. The appellation 'Burma' evokes an aura of adventure and romanticism, with associations steeped in a rich cultural history, lush countryside, grand architecture and fascinating foreign cultures. Burma - now known as Myanmar - has achieved near-mythical status amongst ruby-lovers.

Determination of origin

The geographic origin of this 4.79 ct ruby has been determined by comparing its gemmological properties with those of rubies 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 rubies, 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].

[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 rubies in Burma are the consequence of a major geologic event, when the Indian subcontinent drifted towards the Eurasian plate and eventually collided into it, a process that started some 64 million years ago and is ongoing to this day. This collision resulted in a thickening of the earth's crust – forming the Himalayan mountain range – and triggered the formation of rubies along that plate boundary, stretching from Tajikistan, Afghanistan, Pakistan, and Nepal, to Burma, Vietnam and Thailand [ACA]. By applying radiometric dating techniques, we know that Burmese rubies, such as the 4.79 ct ruby presented here, formed some 30 million years ago at a depth of around 10 kilometres below the earth`s surface, at temperatures between 550 to 700 degrees Celsius.

Major ruby deposits

TREATMENT

Heating has been applied for centuries, and even millennia, to improve both the colour and clarity in corundum. References in Pliny show a diverse knowledge of various mineral treatments in the Roman period, and explicit literary references to the heat treatment of ruby are found in early mediaeval Arabian and Renaissance European texts [ACA].

Generally, heat treatment offers a way of turning rubies of less desired quality into highly attractive gems. Treatment is thus an important way of overcoming the enduring undersupply of aesthetically appealing gemstones. However, each treatment must be properly and accurately disclosed, as the presence and the type of treatment influences the value of a ruby significantly.

The small number of natural, unheated rubies of good colour and transparency, compared with their heated and otherwise treated counterparts, underlines their rarity. The 4.79 ct ruby presented here is one such rare example of unheated ruby, gifted naturally with an attractive colour and transparency.

WITHIN RUBY

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 parts 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 4.79 ct ruby, 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 ruby include blue colour zoning and fine rutile needles and particles, together with pronounced straight and angular growth zonation. These inclusions are regularly observed in Burmese rubies and are potentially helpful indicators to determine their authenticity and origin[2].

Further to these characteristic inclusions, altered healed fissures and flux-healed fissures are other internal features present in this 4.79 ct ruby.

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

Dense mineral dust, partly oriented in flakes, as seen in this 4.79 ct Burmese ruby. The dust surrounds altered healed fissures.

Chemical features

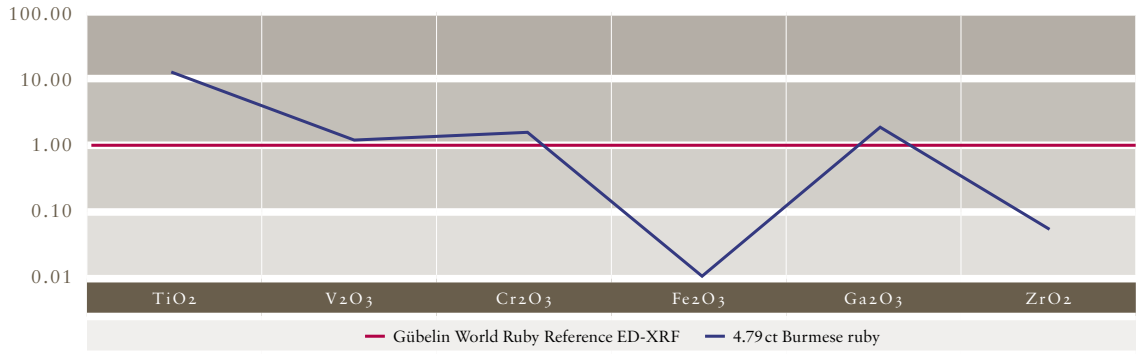
In addition to microscopic features, a number of technologically advanced analytical methods are deployed to allow for a secure determination of a gemstone's authenticity and – with limitations – its origin. These more sophisticated methods can be grouped into spectroscopic and chemical methods. Both 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 trace 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.

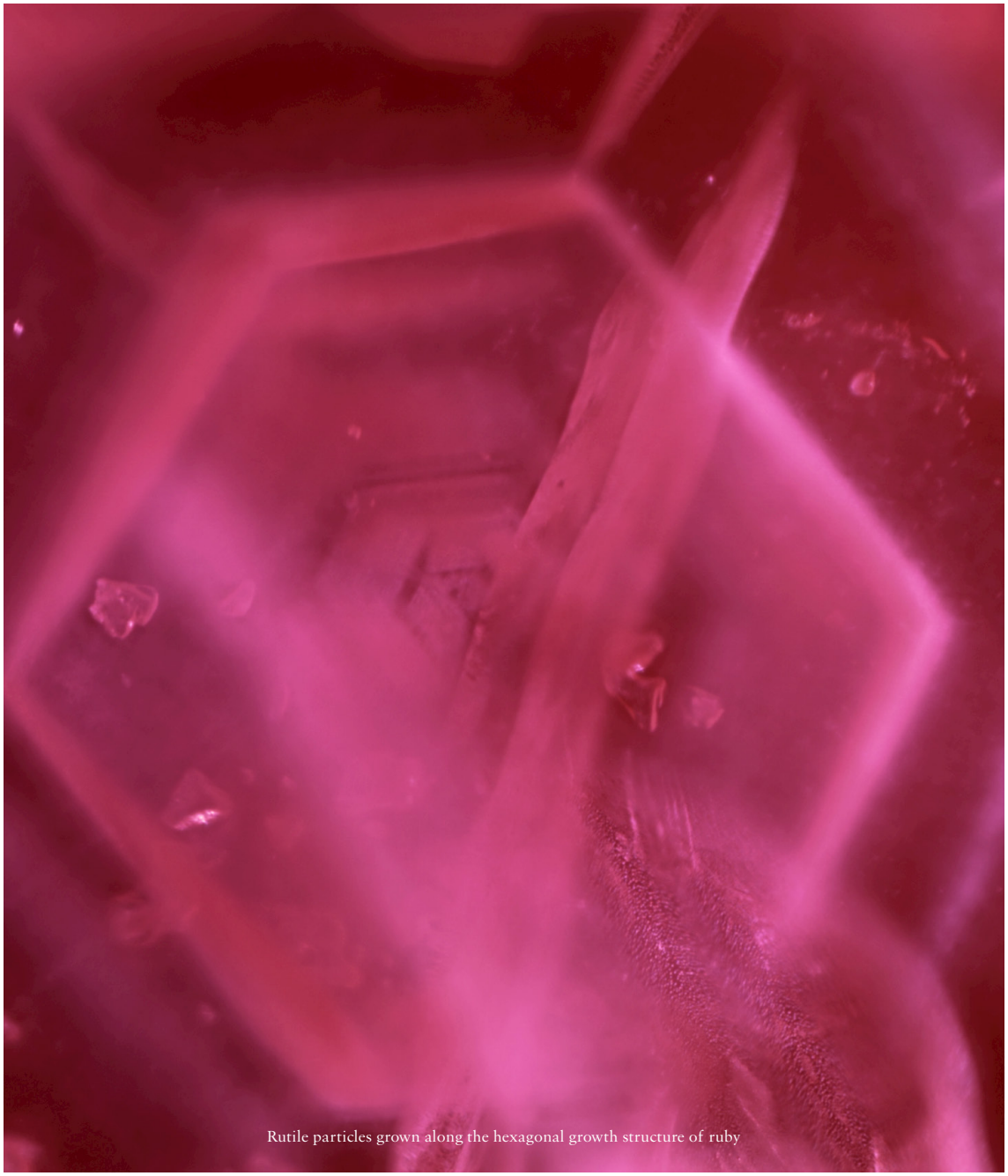
The trace element concentrations of this 4.79 ct ruby vary slightly to the Gübelin World Ruby Reference[4], as shown in the trace element diagram. The individual and truly unique chemical fingerprint measured in this 4.79 ct gemstone displays the characteristic deviations we expect for a ruby from the Mong Hsu area in Burma.

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

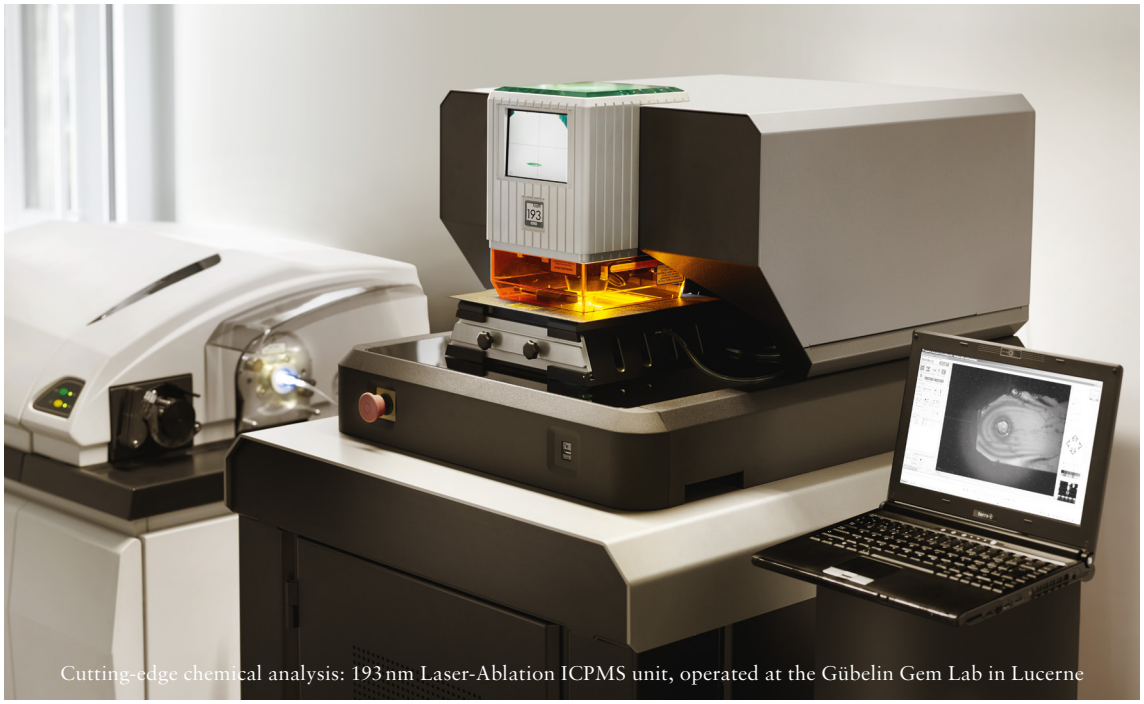
[4] The Gübelin World Ruby Reference is an empirical trace elemental composition of an assumed ruby with the averaged and weighted concentration of potentially indicative elements, comprising all commercially relevant deposits worldwide.



Trace element pattern for the 4.79 ct Burmese ruby, 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 Ruby Reference, shown in red.



Rutile particles grown along the hexagonal growth structure of ruby



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

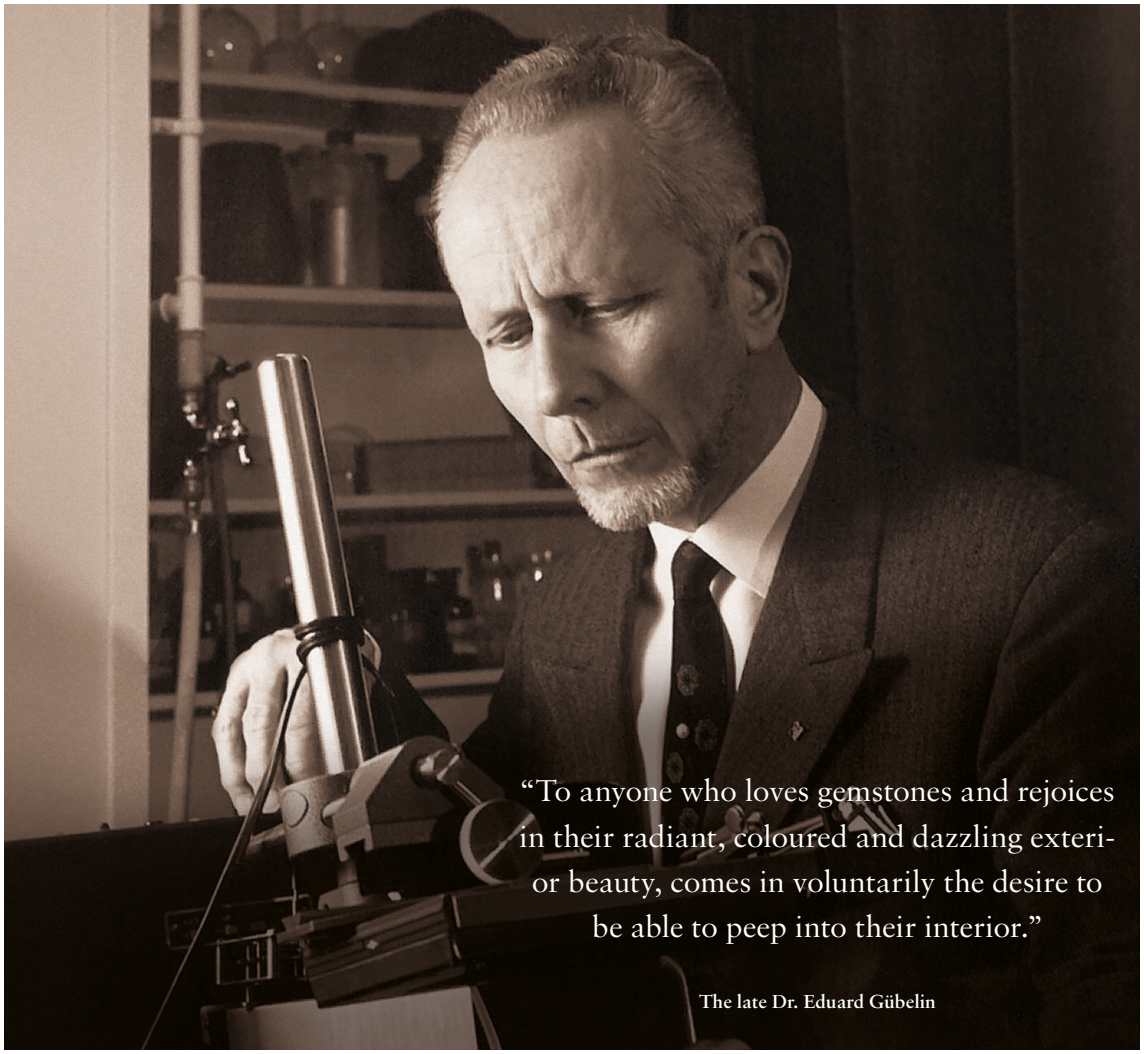
Spectroscopic features

Different methods of spectrometry are applied to help determining possible treatments and the origin 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.

For rubies, infrared-spectroscopy is an essential technology to detect alterations of submicroscopic particles induced by man-made heat treatment.

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 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