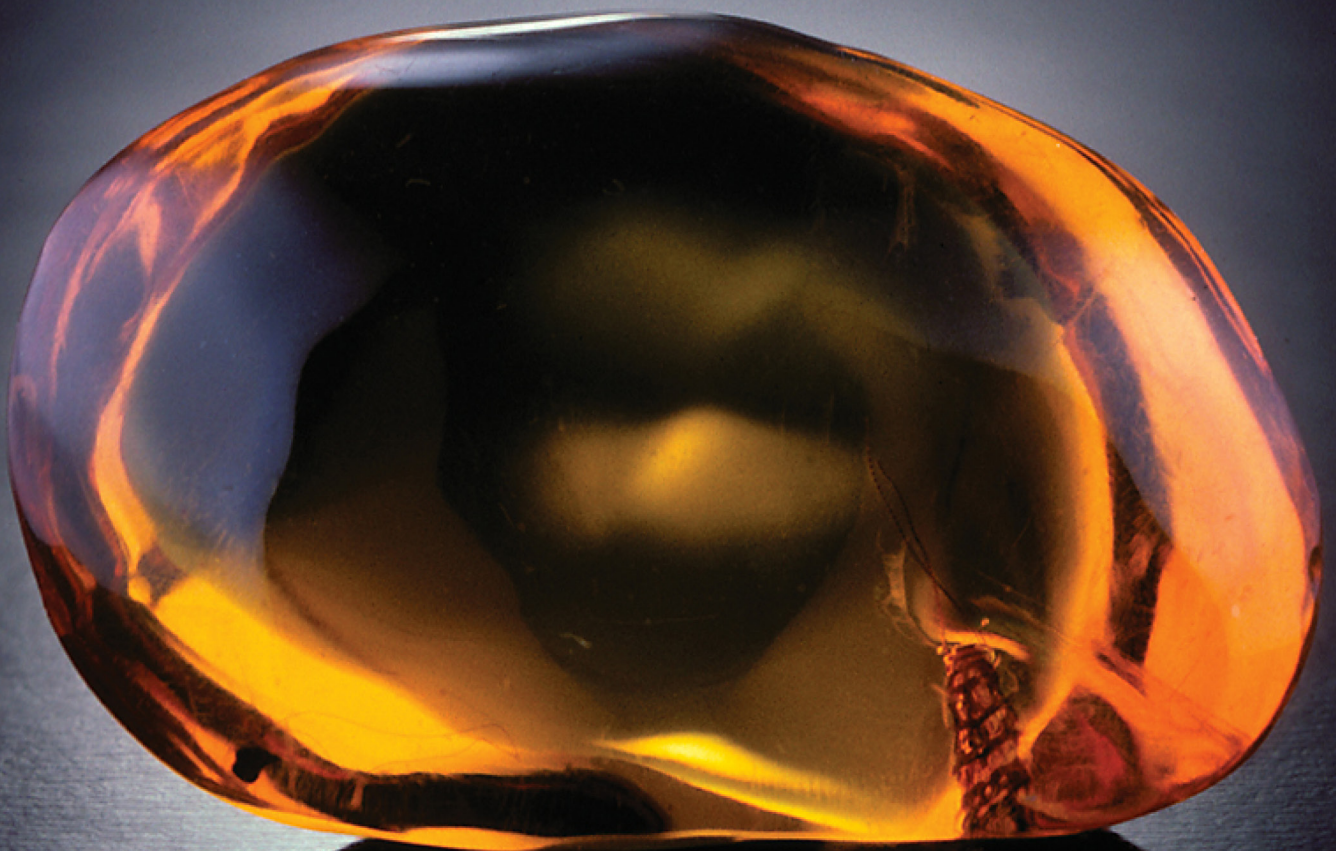


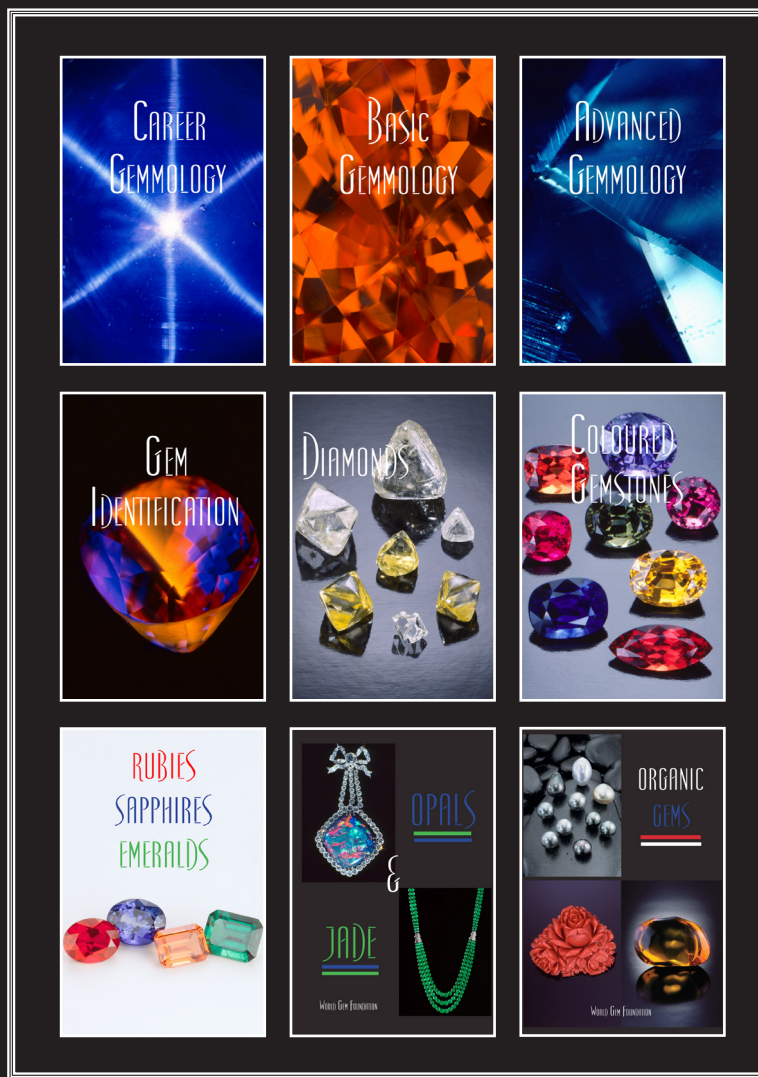


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March 2019
Quarterly Publication



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Amber Cover Photograph by Tino Hammid

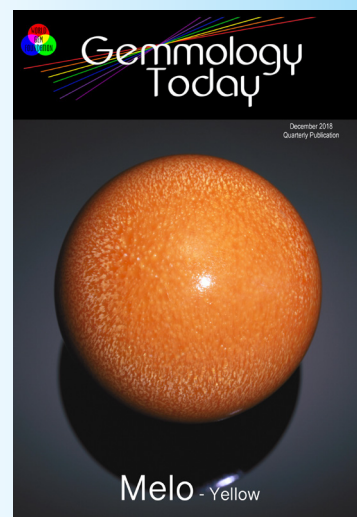
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December 2018 Issue



Editor — at Work

Geoffrey M. Dominy is the author and creator of the 'The Handbook of Gemmology', founder of the World Gem Foundation and editor of Gemmology Today.



In the November 2016 issue of Gemmology Today I wrote an article entitled 'GOD SAVE....US' about the fall-out from the BREXIT vote. Some questioned why a political article should find its way into a gemmological publication. Well the answer is simple; luxury items are always the first casualties of economic uncertainty.

Let's look at the British Pound in relation to the Euro. On May 31st, 2016, 1 GBP = 1.3124 Euros. On February 26th, 2019, 1 GBP = 1.16 Euros. A decrease of 11.61%.

Now there are two ways to look at this; on the one hand European buyers have just increased their buying power by 11.61%. On the other hand, British buying power has just decreased by 11.61%. The weak British Pound will make British goods more affordable to European buyers but after March 29th, 2019, no-one, including the politicians can tell us what will happen. A BREXIT without a deal will be disastrous. A BREXIT under the terms Theresa May has negotiated will be equally disastrous. With both the Conservative and Labour Parties slowly imploding and Jeremy Corbyn finally entertaining the idea

of a 'People's Vote', the next few weeks are certainly going to be interesting. Fortunately I am now a Spanish resident so the fall-out for me personally will not be huge but this is a vote that has and will continue to have far-reaching implications, not just for this generation but for generations to come. The 'devaluation' of the British Pound alone has affected everyone, make no mistake about that, from pensioners living abroad to every consumer item that has been imported into Britain.

If buying British goods and having them exported to the EU results in huge amounts of 'red-tape' and duties, I am not sure the increased buying power that EU buyers are enjoying will be enough to offset these 'added' costs. At this present moment, if these 'added costs' are more than 11.61%, then it would hardly be worth it.

Some politicians and media are likening the current situation to Britain during the Second World War and the undiminished spirit of the British people. The problem of course is that with a growing list of respected companies already pulling out of Britain or severely cutting back on production (Airbus, Aviva, Bank of America, Merrill Lynch, Barclays, Credit Suisse, Dyson, Ford, Goldman Sachs, Honda, HSBC, Jaguar Land Rover, JP Morgan Chase, Lloyds of London, Michelin, Moneygram, Nissan, Panasonic, P & O, Philips, Rolls Royce, Sony, Toyota and USB to name a few), will the reality just end up being a horrible dream.

I can already hear the 'Leavers' screaming 'Let's Make Britain GREAT again' but will that really happen?

A big thank you to all our contributors and you, our readers, for making Gemmology Today such a success!

Meet Lisi Fracchia



Lisi Fracchia

GT: Who is Lisi Fracchia? Tell us about your background?

LF: I am a gem expert and jewellery designer, but my journey has been a long and interesting one. I am originally from Patagonia, in Argentina, where I worked as a schoolteacher. I then married a geologist, whose career moved us to Madrid in 2006. It was then that I decided to do something different with my life, and explore my true passion...gemstones.

GT: When did you first develop a passion for gemstones and jewellery making? Was there a defining moment when you realised this was what you wanted to do?

LF: By this time I had already travelled the world, collecting opals and pearls in Australia, diamonds in South Africa, and

tourmalines in Brazil. Buying them without knowing why, they called my attention but I kept them and treasured them until the moment arrived, when I realised I wanted to take the next step and convert my passion into a career. I took my first classes at the Gemological Institute of Spain, and never looked back.

From 2009 to 2013, my husband's job took us to Brazil, the true paradise of gems. It seemed like fate had taken over. There, I had the opportunity to continue my studies, and took classes in gem expertise and metalwork. I was able to dedicate my time to perfecting my skills, working with the foremost professionals of the field. Retired professionals from H Stern and Amsterdam Sauer were my teachers in metalwork.

When we returned to Madrid, I was prepared to dedicate myself to designing. In 2014, I received the Iberjoya award in Madrid, which assured me that I was on the right path, and motivated me to continue with even more passion.

GT: Natural talent or acquired through study?

LF: Both. I have always been told that I have an artistic eye, and I love to draw. This has been useful to me my whole life, and my talent has served me well in my life's endeavors. Having said that, raw talent can be compared to a diamond in the rough. Without being cut and polished, it will never reach its potential. I have had to study and work very hard in order to get where I am. I am extremely grateful to the people in my life who have supported me, from my teachers to the exceptional professionals with whom I work.

GT: What is the one most memorable piece of jewellery you have made and why?

LF: Seeing Queen Letizia wear one of my sphalerite creations was an unquestionably satisfying and emotional moment. Who better to showcase sphalerite pieces? I was and am, incredibly honored. Knowing that several queens, duchesses, and celebrities choose my pieces is quite a humbling experience. I put my heart and soul into each unique design. It is gratifying to see them appreciated on such a grand scale.



Queen Letizia of Spain wearing 18Kt Matt Yellow Gold Earrings with Sphalerites, Tsavorite Garnets & Opals
(Photo by José Gegundez)

GT: What is your favourite gemstone to work with?

LF: Sphalerites have by far become a symbol of Lisi Fracchia designs. These gorgeous but soft gems that come from the world famous Aliva sphalerite mine in Cantabria, Spain have both a very high refractive index and an extremely high dispersion, qualities that I love. I have the honor to work with one of the few people in the world who knows how to cut them successfully, Dr. Egor Gavrilenko. It also has a special place in my heart since gem sphalerite is the most outstanding Spanish gem material and I consider Spain, my adopted country.

GT: Tell us about some of the famous people you have designed jewellery for?

LF: Due to protocol, I use the utmost discretion when discussing clients, however, I can say that when I was awarded the National Fashion and Business Excellence Award, in the category of Jewellery Designer, at the PRENAMO awards this year, given by ANDE (National Association of New Spanish Designers), the Viscountess Maribel Garcigrande wore an original design I made for her in 18K rose gold, set with morganite (pink beryl), kunzite, tanzanite, indicolite tourmaline and heliodor (yellow beryl). Diane Jarrett, a graduate gemologist (GG, GIA) and Registered Master Valuer; the jewelry industry's most prolific published journalist with such credentials, has been a long-time supporter of mine. When a professional, such as she, appreciates my work, it means the world to me. This is her field. She has the expertise to judge, and her approval and encouragement have motivated me like no one else.

GT: Where do you find your inspiration?

LF: I have always been inspired by my surroundings. From the rich colors and gorgeous landscapes of Argentina, to the geometric shapes of the world's cities. I have enjoyed living in many places, and I try to reflect my appreciation for the beauty and uniqueness of each place in my pieces. They are tangible pieces of inspiration and fond memories that I share with the world. Hopefully, they will import these feelings to others.

GT: Walk us through the design process.

LF: I design unique exclusive pieces or limited handmade editions like the collections Sphalerite Dream, Patagonian Glaciers, Elche, Atardecer en el fin del Mundo and other massive ones made in 3D like Kids, Anniversary, Puro Glamour. What fascinates me is to work with gems that are rarely used in jewelry such as apatite, heliodor, kunzite, tsavorite and of course, sphalerite.

GT: Where do you see the future of gemmology ten years from now?

LF: Gemology is a science that is not widely known. I would like to help change that. Perhaps because I started as a teacher, I have the desire to teach designers, jewelers as well as the general public about gemology. Through my pieces, you can learn to appreciate the properties of different stones and materials, and hopefully, your interests will be piqued. Through conferences, articles, and interviews, such as this one, people will be able to learn that there is more to jewelry and design than most people think. It is the union of science and art.

GT: If we were sitting here a year from now celebrating what a great year it's been for Lisi Fracchia professionally, what would you say was the reason?

LF: I would like to make more alliances with fashion designers, makeup lines, influencers, actresses and bridal stores. By this time next year, I hope that 'elegance and style' will be synonymous with Lisi Fracchia.

I am also collaborating with Roberto Piazza, the distinguished and talented Argentine designer, on a fashion show that will be held at the Embassy of Argentina. Through events such as this, I hope to not only educate the public about special gemstones such as sphalerite and yellow beryl (heliodor) but also to make them aware of who I am and what my brand represents.

You can contact Lisi on Facebook and Instagram @lisijoyas or through her website at www.lisifracchia.com



Lisi receiving 'El Premio Prenamo a la Joya de Autor'



Viscountess Maribel de Ortiz Vizcondesa de Garcí Grande wearing pieces of the Patagonian Glaciers Collection



Sterling Silver Rings set with Swiss Blue Topaz, Rio Grande Citrine, Peridot, Quartz, Amethyst, Indicolite Tourmaline, Rhodolite Garnet & Tanzanite



18Kt Yellow & White Gold Earrings set with Garnet, Citrine Quartz, Peridot, Blue Topaz, Aquamarine, Tsavorite Garnet & Amethyst Quartz



18Kt White Gold Pendant set with Sphalerite, Diamonds, Opal & Tanzanite



'Five in One' 18Kt White Gold Earrings set with Yellow Beryl (Heliodor), Diamonds & Sapphires

18Kt Yellow Gold 'Removable' Earrings set with Diamonds, Russian Chrome Diopside & Yellow Beryl (Heliodor)



18Kt Rings set with (Top Row) Rio Grande Citrine Quartz, Smoky Quartz, Citrine Quartz & Aquamarine (Bottom Row) Amethyst Quartz, Tourmaline, London Blue Topaz & Amethyst Quartz (Rio Collection)



Interchangeable Set - 18Kt White Gold Tanzanite, Topaz & Diamond Earrings



Interchangeable Set - 18Kt White Gold Tanzanite & Diamond Earrings



18Kt White Gold 'Removable' Sapphire & Diamond Earrings



18Kt White Gold Earrings set with Apatite, Pink Tourmaline & Tanzanite



18Kt White Gold Rings set with Green Tourmaline, Pink Tourmaline (Rubellite) & Yellow Beryl (Heliodor) with Diamond accents



18Kt Yellow Gold Pink Tourmaline (Rubellite) Ring
(Roundtrip Collection)



18Kt Rose Gold Tanzanite & Santo Domingo Aquamarine Ring



18Kt White Gold Yellow Beryl (Heliodor), Apatite & Diamond Pendant (Patagonian Glaciers Collection)

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Article Submissions

The deadline for the next issue is

May 15th, 2019

Guidelines:

- We do not accept highly scientific articles.
These are better suited for either the Journal of Gemmology or Gems & Gemology
- All articles should be a minimum of one page.
- All accompanying photographs must be high resolution and must be accompanied by written permission to use the images unless the author owns the rights. Wherever possible please try to supply images from the same photographic source or are at the very least compatible with each other. This will ensure that the article is aesthetically pleasing as well as informative.
- We reserve the right to refuse articles

E-mail all submissions to
information@worldgemfoundation.com

The Greatest Show on Earth?

This year, I was fortunate to spend the first two weeks of February at the most impressive, diverse and occasionally quite overwhelming gem and jewellery show on Earth. Simply put, this annual extravaganza in Tucson, Arizona is a rockhound's ultimate dream.

This was my second visit to Tucson, so I had some idea of what to expect. Even so, one cannot fail to be impressed by the vast array of gems, jewellery, mineral specimens, fossils, sculptures, artwork and a whole lot more besides. The sheer scale of it all is a struggle to take in.

The term 'Gem show' is a little bit misleading. For a few weeks in January and February each year, the city is dominated by a multitude of activities all across town. It's not only the large venues that host events. Everywhere you turn there is something happening related to gemstones and jewellery. There are little pop-up shops and big tents in car parks, hotels and motels converted into gem fairs and

you can even find people selling their wares from a blanket on the sidewalk (or pavement, if you're a Brit). Our industry comes to town in a big way.

You certainly need to be up to speed with your acronyms. Don't confuse your JOGS with your JGM or your JCK. All very different events! The main shows for me are AGTA (American Gem Traders Association) at the Tucson Convention Centre and GJX (Gem and Jewelry Exchange) which is just across the road. Each of them run for 6 days and you could easily spend that long looking at everything on display. I visited each one several times and, if you only have a short time in town, those are the places to start. After that, if you still have some time and energy, there is the magic of Pueblo at the Ramada Hotel. You can lose yourself wandering in and out of the hotel's bedrooms, each one converted into an Aladdin's cave, full of precious stones and other treasures. I spent a while in one room learning about the peridot from the San Carlos Apache Reservation and then had a lesson in rainbow lattice sunstone from an Australian gem cutter.



Photo by Stuart Pool

All over town, you'll find industry people - designers, retailers, importers, dealers, lapidaries and manufacturers. One of my favourite things to do is seek out the actual miners. There are quite a few around. From Australia, South America, Africa and even Europe (in particular a purveyor of Finnish spectrolite), you can find people here who are actually digging the gemstones out of the ground themselves. Of course, there are quite a few US rockhounds too. They all have fascinating stories to tell about their exploits hunting for gems and minerals. Before you know it, an hour has passed just chatting at one booth!

As an advocate of traceable and transparent sourcing, the few things I bought for my collection in Tucson came from miners or people with a clear and direct link to the mines. For me, the saddest thing about the whole Tucson experience is that there is so much material I cannot buy because of its lack of traceability. However, there is some cause for optimism on that topic, as increasing numbers of people are putting more effort into tracing their supply chains. The times are changing...

To reach some of the shows, you will need a car or an Uber account. Tucson is a city that sprawls in every direction and a few of the events are a little way from the centre of town (notably the Marriott Starr Pass Hotel, which hosts the JCK show and many of the parties). Don't forget to pace yourself too. The desert environment creeps up on you and the danger of dehydration is real. It's all too easy to be distracted by the shiny things and forget to top up your water bottle. I should mention that there is a free shuttle service that will ferry you between some of the shows, but the buses run on one-way loops and waiting times can be long. Something you don't want to do in the Arizonan sunshine.

This is definitely a place to do some business. There are deals being agreed left, right and centre, ranging from a few strings of beads to a 6-figure piece of bejewelled artistry (and all things in between). However, it isn't only about the buying and selling in Tucson. There are numerous conferences, workshops and lectures. My first two days were spent at the Jewelry Industry Summit, a key event if you're interested in the responsible sourcing of jewellery materials. We had an excellent line-up of speakers, covering topics from emerald mining in Pakistan to the accurate use of jewellery terminology. You will find any number of educational opportunities, often with some of the most renowned experts in their fields. The AGTA talks are amongst the best, although there seemed fewer of them this time compared to my previous visit.

Without doubt, Tucson is about meeting people too, both making new friends and seeing old ones. The networking opportunities (by this, I mean the parties) are happening almost every night (and sometimes during the day too!). I was lucky enough to attend the so-called 'Big Bash', hosted by Gem-A (the Gemmological Association of Great Britain), in my opinion one of the best. Other big events were put on by GIA, WJA, Ethical Metalsmiths, Gemmology Worldwide. The list goes on... I found time to attend a lunchtime presentation by Greenland Ruby, a talk on the Provenance Proof platform from Gubelin and the launch of Gem Legacy, a charitable initiative working in East Africa. At these events, you can often find many of the key people in the industry and some say it is at the parties where the real business is done.

Beyond the shows and the talks and the parties, Tucson offers plenty of options to tourists too. If you do find a spare minute or you simply need a break, you can visit the OK Corral in Tombstone and watch Wyatt Earp in a gunfight, check out the wildlife in the Desert Museum and go hiking or biking in the mountains (don't forget your water!). Foodies should be aware that Tucson is a UNESCO City of Gastronomy, so you'll find all kinds of culinary delights too. The local craft beers aren't too shabby either.

I realise there are many big gem and jewellery shows across the world. However, I would argue that Tucson is the one that everyone in our industry must experience at least once in their lives. There is simply so much diversity on such a massive scale that you are guaranteed to find something (probably several things) that you love. Of course, it's entirely likely that the 'once in a lifetime' trip becomes an annual pilgrimage...you have been warned!



Photo by Stuart Pool



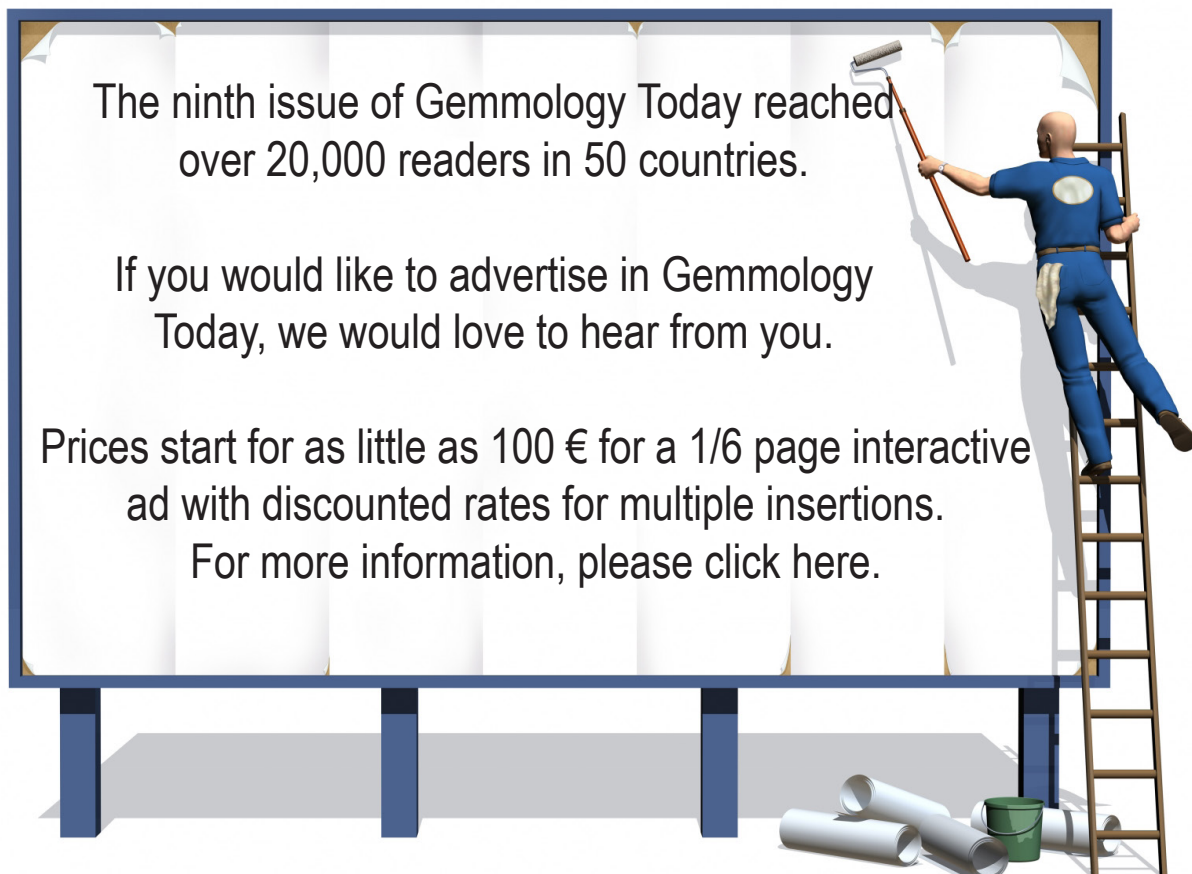
Photos by Stuart Pool

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Gemmology Today Quiz #10

Let's see how much you know about Jade?

CLICK ON THE IMAGE TO START

Carbon Copy

The World of Diamonds

JAN ASPLUND is the joint CEO of the Scandinavian Gem Academy. He received his FGA (Diploma in Gemmology) and DGA (Gem Diamond Diploma) through Gem-A in 2011, his BA in History from the Mälardalens University in 2000 and studied geology and gemmology at Luleå Technical University (2005 – 2007).



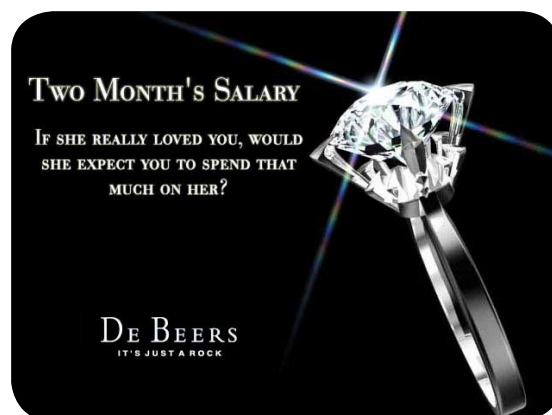
Diamonds for Betrothal and Marriage

The image most people get in their head when a betrothal ring is mentioned is a gold ring with a solitaire round diamond in the iconic Tiffany prong setting launched in the 1890s. Clever marketing is behind much of today's idea of the relationship between love and diamonds. The same clever marketing also suggests how much the diamond is supposed to cost; approximately two months of the grooms salary. The tradition with diamonds in wedding and engagement rings is often blamed on modern marketing, but what does the history of diamonds in engagement and wedding rings look like before the successful marketing campaigns of the 20th century?

Diamonds have been used in finger rings since the 3rd Century BCE. The oldest known example is a ring from Ai Khanoum, Afghanistan. The ring was fashioned in a Greek Hellenistic style suggesting Greek jewellers working in the region. No diamond jewellery dating to antiquity has been found in Greece and Europe's oldest diamond set rings are Roman, dating to the 2nd and 3rd Centuries CE (Ogden 2018 p. 21-22).

Rings have been used for engagement and wedding ceremonies since antiquity but it is not until the late 15th century that we find betrothal rings set with diamonds. During the late Middle Ages, diamonds were still extremely rare but gifts in the form of diamond set jewellery became more common among the nobles in Europe. Examples range from the Duke of Burgundy's gift of a brooch set with diamonds and rubies to his mother, to King Richard II's gifts to his second wife, the then seven year old Isabella of France, to Etienne de Chevalier's gifts to Agnes Sorel, known as 'Dame de Beauté', the French King Charles VII's favourite mistress (Bruton 1978 p. 13-14; Dickinson 1965 p. 156).

Which finger and which hand to wear the rings on have differed over time and to wear the ring on the left hand become standard only after the 'Book of Common Prayer' was published in England in 1549 (Phillips 2008 p. 44). The wedding ring is traditionally worn on the 4th finger on the left hand, a tradition that has its roots in ancient Greece and



De Beers Marketing

Rome and might be a result of the belief in a 'vena amoris' - the vein of love, a vein that was believed to run from the finger directly to the heart. However, a more practical and less romantic reason for this tradition could be the simple fact that since most people are right-handed, wearing a ring on the left-hand resulted in less wear and tear on the ring and the risk of potential damage. (Monger 2013 p. 567).

During the wedding between Constanzo Sforza and Camilla D'Aragona in 1475, for the first time, a diamond played a central role in a marriage. It is not known if a ring set with diamonds was exchanged but in a series of miniatures that were made for the occasion, one has a picture of Hymen, the Greek God of marriage, wearing a robe with a pattern of rings with diamonds. Hymen is standing next to a table with two torches held together by a large ring with a diamond and the picture includes the text:

'Due Gace in uno anello de ardente focho
Doi volunta, doi cor, doi fochi insegna
Che siam congiunti in vinculo de diamnte'

Translated to English:

'Two torches in one ring of burning fire
Two wills, two hearts, two passions
are bonded in marriage by a diamond'

Two years later, in 1477, a diamond ring was exchanged during the engagement between Maximilian of Austria and Mary of Burgundy. Maximilian's father gave the ring in question to Mary after she had promised to marry his son (Ogden 2018 p. 9). A second ring, a plain gold band, was the wedding ring (Dickinson 1965 p.156). The symbolism with diamonds durability and hardness was clear and during the 16th century, the diamond set ring became a common part of a marriage among nobles in Europe (Scarisbrick 1998 p. 164).

In 1502 Marion Chambers wrote in her diary that a ring for marriage was made of gold and had a diamond and a ruby. The Tudors of England encouraged the diamond symbolism by giving away diamond rings as both love and loyalty pledges (Dickinson 1965 p.159). The two-year old daughter of Henry VIII, Princess Mary, received a diamond ring as a symbol for her engagement to the baby dauphin of France. That marriage contract was not fulfilled but four years later, Princess Mary was engaged to her cousin Charles V with another diamond set ring (Scarisbrick 1998 p.164).

Betrothal rings found their way into fiction and several of Shakespeare's characters exchanged rings (Dickinson 1965 p.161). In 1652 Thomas Nichols stated that due to their hardness and durability, diamonds were suitable symbols for signification of consistency (Ogden 2018 p. 9). By the second half of the 17th century rings with diamonds had become a standard among royalty and nobles in Europe.

With the discoveries of diamonds in Brazil in the 1720's the supply increased and a demand for larger diamonds for engagement and wedding purposes rose. The technical development of tools and techniques for cutting diamonds

paved the way for new designs and many diamonds started to be cut in ways resembling the modern brilliant. In 1761, King George III presented Queen Charlotte with a solitaire diamond ring, a style of engagement and wedding ring still popular today (Antique Jewelry University).

The importation of diamonds to Europe from Brazil rose significantly between 1740 and 1770 with an average annual influx of over 50,000 carats. This was followed by a slight decline in imports in the early part of the 19th century, however between 1850 and 1851 approximately 300,000 carats were imported. During this time, Brazil dominated world diamond production with the former most important producer India, along with the small producer Borneo producing less than 1 percent of the world production until 1870 (Lenzen 1970 p. 121-122).

From the 1870's, South Africa dominated world production and this was certainly the beginning of the modern era of diamonds in jewellery. The marketing campaigns orchestrated by De Beers in the 20th century created today's demand for engagement and wedding rings with diamonds and while many think this was a 20th Century invention, in reality it was simply a re-branding of a tradition that dates back several centuries, rooted in early Renaissance Europe, but on a much grander scale.

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Diamond Solitaire Ring (Photo by Tino Hammid)



De Beers DTC - 'Waiting' Campaign



Titanium - Heating Rutile is Never Futile



Titanium was discovered in Cornwall, England in 1791 by William Gregor, a clergyman and amateur geologist, during his analysis of black sand that he had found by a stream. Upon testing the sand, he found that it contained two metal oxides; iron oxide (that produced a magnetic attraction) and an unknown white metallic oxide. He subsequently reported his findings to the Royal Geological Society of Cornwall and the German scientific journal *Crell's Annalen*.

Four years later, Martin Heinrich Klaproth, a Prussian chemist, independently rediscovered the very same metallic oxide in samples of rutile from Boinik in Hungary and named it 'Titanium' after the Titans of Greek mythology.

Titanium has a chemical symbol of Ti, an atomic number of 22, an atomic weight of 47.867, a density of 4.506 g/cm³ and a melting point of 1,668 °C. It occurs within a number of mineral deposits, principally rutile and ilmenite.

Gemmologically speaking, rutile is a very important inclusion that is found in most rubies and sapphires and is composed primarily of titanium dioxide (TiO₂).

Titanium dioxide is used in a number of industrial applications, ranging from paint to sunscreen and even food colouring. In 2014, world production exceeded 9 million metric tons. It is used in two-thirds of all pigments with an estimated value of \$ 13.2 billion USD.

As we have seen in previous articles, transition metallic elements play a key role in the colouration of gemstones and can have a profound effect on the value of a gemstone.

Blue Sapphires

While we may think that increasing the concentrations of iron and titanium will result in a more intense blue colouration, research conducted by Häger (1992, 1993, 2001) and Emmett and Douthit (1993) showed that there was little or no correlation between the concentrations of iron and titanium and the saturation of blue colouration. This proved that it is the interaction of the impurities that is often more important than the presence of the impurities.

Oh no.....not more chemistry.....

Yes, I am afraid so. You see it is simply impossible to explain the interaction of these impurities without at least dipping our toes in the 'chemical' waters, so please bear with me.

The Tale of Two Blue Sapphires

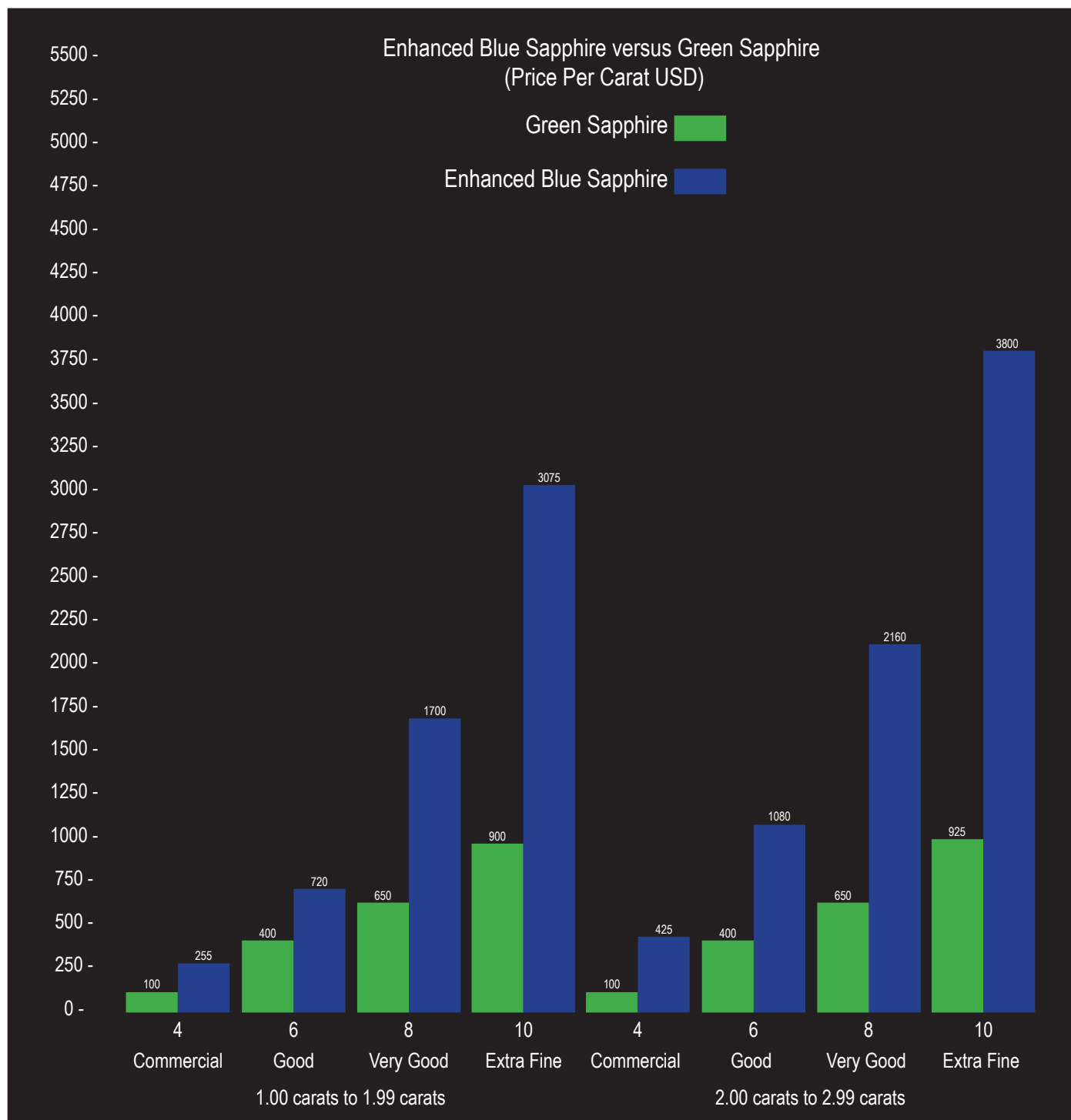
If we were to heat two blue iron-containing sapphires in a reducing (oxygen-free) environment, one with 60 parts per million atomic (ppma) of Ti⁴⁺ and the other with exactly the same amount of iron and titanium but also an additional 40 parts per million atomic of Mg²⁺. The sapphire containing Mg²⁺ would be lighter in colour but why?

Donors and Acceptors

Ions with an excess positive charge are termed **donors** and must give up an extra electron to enter the corundum lattice. Ions on the other hand with a -1 charge, known as **acceptors**, must acquire an electron from some other ion in



Star Sapphire (Photo by Tino Hammid)



Reference: GemGuide January/February 2017

the lattice. In the case of our two sapphires, the Ti^{4+} has one extra positive charge than the Al^{3+} it needs to replace while the Mg^{2+} has one less. Because of this +1/-1 relationship, titanium and magnesium will tend to attract each other because one is a donor and the other is an acceptor and their interaction will result in a balanced charge.

In the first instance, the 60 ppma of Ti^{4+} would form $Fe^{2+} - Ti^{4+}$ pairs while in the latter case, only 40 ppma of the Ti^{4+} charge compensates for the Mg^{2+} leaving only 20 ppma of Ti^{4+} to form the $Fe^{2+} - Ti^{4+}$ pairs (John L. Emmett, Kenneth Scarratt, Shane F. McClure et al 2003).

In nature, corundum grows at a temperature between 250 degrees Celsius and 1400 degrees Celsius, while lab-created corundum is grown at temperatures that are very close to its melting point (2045 degrees Celsius).

This is significant for two reasons.....

In nature, it is far more probable that titanium will be charge compensated by a divalent ion having a valency of 2 (Mg^{2+} or Fe^{2+}) because of the donor/acceptor relationship (+1/-1) than by a vacancy or an interstitial ion. However, in the case of laboratory grown corundum or stones that are subjected to high temperatures, the probability that the charge

compensation will occur through a vacancy, an interstitial ion or a hole increases.

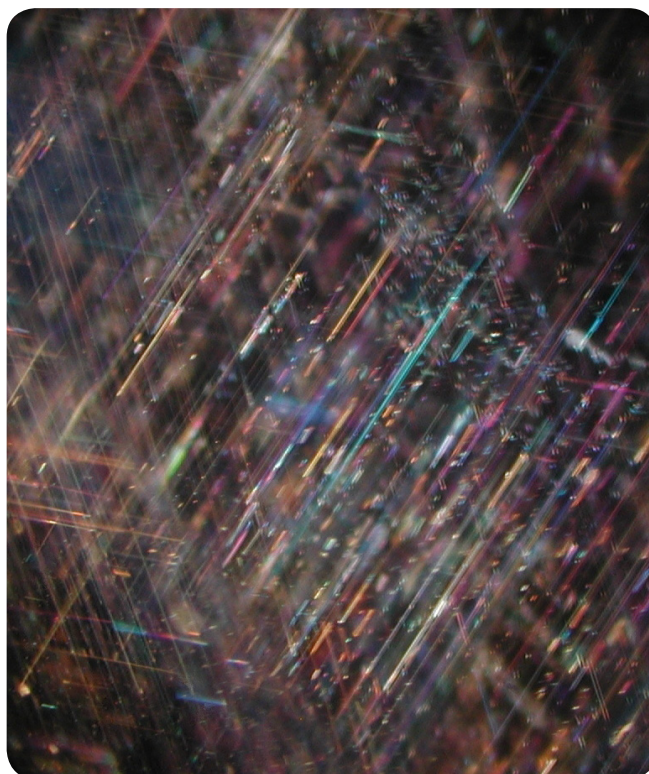
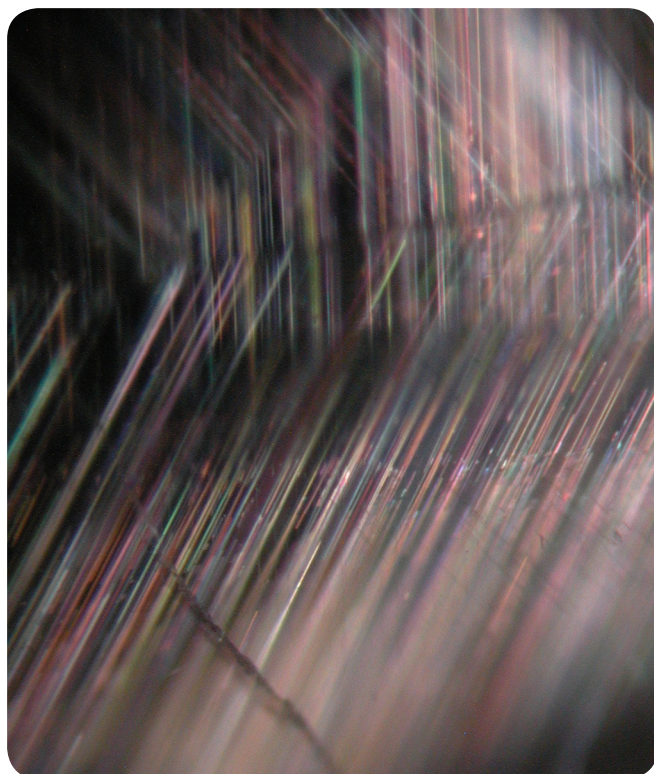
By heating stones in a reducing (oxygen-free) environment, at temperatures ranging from 1500 to 1800 degrees Celsius, it is possible to convert the ferric oxide (Fe^{3+}) to ferrous oxide (Fe^{2+}) causing a deepening of the colour. Conversely, if the stones are heated in an oxidized (oxygen-rich) environment, the ferrous oxide (Fe^{2+}) converts to ferric oxide (Fe^{3+}) causing a lightening of the stones.

In blue sapphires that contain rutile needles, heating them progressively through 1200 to 1800 degrees Celsius can intensify their colour through the complete (the melting point of rutile is stated at 1843 degrees Celsius) or partial dissolution of the rutile (titanium oxide) that slowly diffuses the titanium into the stone. This technique was used to great effect by the Thai dealers who purchased seemingly worthless 'Geuda' from Sri Lanka in the 1960's.

In sapphires that display 'asterism' (star effect), the rutile and hematite/ilmenite inclusions form along the basal plane in three directions, crossing at 60 and 120 degrees, producing both 6 and 12-rayed stars.



Blue Sapphire (Sri Lanka) (Photo by Tino Hammid)



Rutile Silk in Unheated Sri Lankan Blue Sapphire
(Courtesy of Peter Grumitt – Apsara co.uk)

The Great Dilemma

While gemstone treaters are happy to heat treat blue sapphires to improve their colour and often their clarity, working with sapphires that exhibit asterism is a tricky proposition.

Star sapphires are prized for the sharpness of their star, it's position and uniformity and their overall colour. Heating a star sapphire will partially dissolve the rutile and improve the colour but this is often at the expense of the asterism and this can have a negative impact on the value.

What Does This All Mean?

Without comparing a 'before' and 'after' heat-treated blue sapphire, it is hard to say how much the value is improved. Since no two sapphires are alike, results can vary substantially. Knowledgeable treaters know what to look for but then again, there are no guarantees.

We can however get a general idea of how much titanium impacts on the value of a blue sapphire by comparing its value to a green sapphire. Why is that you ask? Well while blue sapphires are coloured by iron and titanium, the major transition element in green sapphire is iron.

As we can see from the chart on the previous page, in the 1.00 carat to 1.99 carat weight categories, a blue sapphire in an 'Extra Fine' quality would sell for 241.67% more than a comparable green sapphire while in the 2.00 carat to 2.99 carat weight categories, the difference would be 310.81%. This difference jumps to 440.54% when we move into the 4.00 carat to 4.99 carat weight range.

Conclusions

Firstly, the presence of titanium, like chromium in rubies and emeralds and copper in Paraíba tourmaline does have a major impact on the value. With a 4.90 carat 'Extra Fine' blue sapphire selling for more than \$ 20,000 USD than a comparable quality green sapphire, this is clearly evident.

Secondly, gemstone treaters are certainly going to try and squeeze every last drop of titanium out of a blue sapphire in order to maximize its value. With rutile inclusions being an 'added' source of titanium, it make sense that blue sapphires containing rutile inclusions will be heated to improve their colour. With 'heat treatment' being an 'acceptable' practice that produces a 'permanent' colour change, where is the downside? Unless of course, you are a purist!



Natural Blue Sapphire (8.82 carats) (Photo by Jeff Scovil)

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This is the first of a two part series by Kirk Feral where he investigates the roles chromium and vanadium play in the colouration of gems and how their presence can be detected.

Masters of Green: Chromium and Vanadium

The Dynamic Duo

Chromium and vanadium are metallic elements that often act together as chromophores or coloring agents in gems and minerals, creating a green color. Other metals such as iron and copper can also create a green color, but chromium and vanadium produce some of the most spectacular green hues found in gemstones.

The name for chromium was derived from the Greek word *chroma*, which means color. Chromium can produce red color in gems such as ruby and spinel, and green color in gems like emerald and fine jade. The terms 'ruby red' and 'emerald green' are affiliated with royalty and represent ideal versions of color that have been held for centuries, primarily due to the element chromium.

By virtue of this long heritage, chromium gets all the credit for the best green colors and is by default the king of green in the mineral kingdom. But if chromium is king, then vanadium is truly the queen of green.

Vanadium is named after Vanadis, the ancient Scandinavian goddess of beauty. Like chromium, vanadium also produces stunning green colors that range from delicate light green to rich dark green. On occasion vanadium also creates blue color, as we find in tanzanite and cavanisite.

Because vanadium is often less familiar than chromium and less understood as a cause of green color in gems, it's regarded somewhat as a stepchild to chromium. But as we shall see, the role of vanadium in creating vibrant green color rivals that of chromium.



Emerald (Chromium) & Tsavorite Garnet (Vanadium)

Chromium and vanadium are among the 25 most abundant elements within the earth's crust. For use in industrial alloys, these two metals are mined from ores such as chromite (chromium) and magnetite (vanadium).

On the Periodic Table of Elements, chromium and vanadium have the atomic numbers # 23 and # 24 and are arranged side by side in the first row of transition metals. When ions of chromium and vanadium are dissolved in solid solution within gemstones, the ions combine with oxygen to form oxides that give rise to green color: chromium oxide (Cr_2O_3) and vanadium oxide (V_2O_3). Undissolved chromium oxide takes the form of a pure green powder.



Chromium Oxide

The chromium and vanadium ions found in these metal oxides exist in the trivalent oxidation state: Cr^{3+} and V^{3+} . Trivalence simply means that each atom has gained a positive charge of 3 after losing 3 electrons when binding with oxygen. Depending on the type of mineral, trivalent chromium can produce either green color or red color. Trivalent vanadium results only in green color in gems, except for zoisite (tanzanite), in which V^{3+} can also produce brown, violet and possibly blue color.

Other valence states of chromium and vanadium create different colors, but these rarely occur among gems and minerals. Quadrivalent vanadium (V^{4+}) within vanadium oxide (VO^{2+}) creates the bright blue color in the mineral cavanisite.

Hexavalent chromium (Cr^{6+}) creates an intense orange color in the mineral crocoite, but in man-made pigments it produces a yellow color. Chrome yellow paint (lead chromate) was common in artist palettes, taxi cabs and school buses until it was determined to be toxic.

Deconstructing Green Color

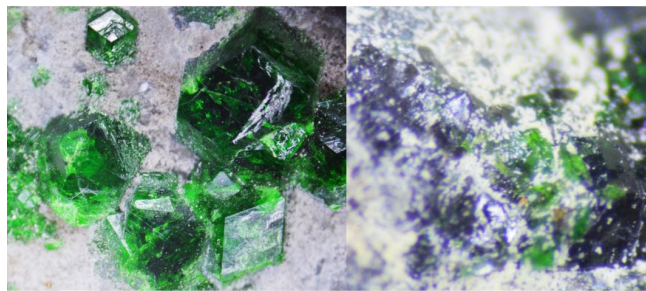
The single most important factor that determines the value of any colored stone is color, and gems with the strongest color generally are the most desirable and command the highest prices. The quality of green color in gemstones in terms of hue, tone and saturation is undoubtedly examined more fastidiously in emeralds than in any other type of gem. Chromium and vanadium almost always occur together as a pair to create green color in emeralds and all other types of green gemstones, and the proportion of chromium to vanadium can vary widely. Gems colored mostly by vanadium can be indistinguishable in color from gems colored mostly by chromium.

The colors produced by chromium and vanadium range in saturation from light to dark, and in hue from blue-green to pure green to yellow-green. With the aid of a dichroscope, we can at times see dichroism within a single gem that reflects these variations in green color: green & blue, or green & yellow.

It's difficult to know precisely how each chromophore by itself affects the color of a single green gem. Does vanadium create exactly the same green color as chromium? The answer is stubbornly elusive, and no information has been published that definitively answers this fundamental question.

We can attempt to find the answer ourselves by looking at examples of natural green gemstones that are colored only by chromium and only by vanadium. Such examples are rare in nature. The nearest approximations of minerals colored entirely by chromium are natural crystals of the uvarovite species of garnet, and also crystals of the chromium-dravite species of tourmaline. The concentration of chromium oxide in these minerals can be as high as 30%, making the crystals opaque. Uvarovite and chromium-dravite both show a dark pure green color.

Two species of mineral colored almost exclusively by extremely high concentrations of vanadium are idiochromatic goldmanite garnet and vanadium-dravite tourmaline. Near-opaque crystals of these vanadium minerals also show a dark pure green color, and can be nearly identical in hue, tone and saturation to crystals with very high concentrations of chromium. So, we know that chromium and vanadium are each capable of creating a pure green color when present in high concentrations within natural idiochromatic minerals.



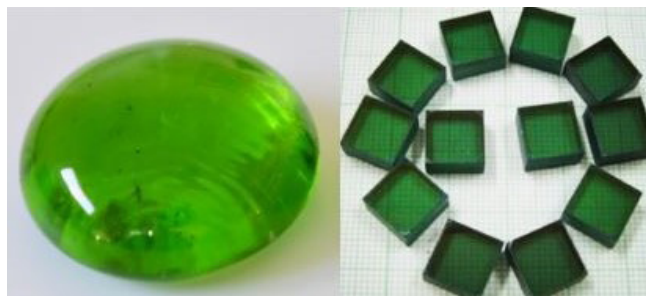
Uvarovite Garnet (Chromium) & Goldmanite Garnet (Vanadium)

Much lower concentrations of chromium and vanadium are found in allochromatic gemstones. To observe the effect of a low concentration of chromium or vanadium on the color of a gem, with no influence from any other coloring agent or impurity, we must turn to lab materials that are manufactured under controlled conditions.

Lab-created materials colored green by only one dopant (coloring agent) are nearly as hard to find as natural gems colored by a single chromophore. For example, most synthetic emeralds contain both chromium and vanadium. Additionally, iron or copper may also be added to synthetic emeralds to modify their emerald color.

I was able to locate a specialty glass colored green exclusively by chromium (Cr^{3+}), and also an industrial YAG (yttrium aluminum garnet) colored green only by vanadium (V^{3+}). These transparent materials contain no other dopants that might affect color.

It turns out that barium phosphate glass doped with 1% chromium shows a bright green color that is slightly yellowish. YAG doped only with vanadium for use in solid-state lasers shows a dark green color that appears slightly bluish. But these are 2 different host materials. A better comparison would be chromium YAG to vanadium YAG, but most chromium YAG is manufactured with thulium and holmium, which can alter the color.



Chromium Glass & Vanadium YAG

The story of color produced by chromium and vanadium in natural allochromatic gemstones is much more complex than what we find in the lab. In most natural gems, does vanadium create a blue-green color, while chromium imparts

a yellow-green color? Can the opposite be true? Does vanadium create a darker green color than chromium, or vice versa? The short answer is that the kind of green color caused by chromium or vanadium varies with the type of gem and with the concentration of the chromophore. My own observation is that a blue-green color and a light color saturation are both associated more often with vanadium than with chromium in natural transparent gemstones.

Researchers have established that the higher the concentration of chromium and/or vanadium within a gem, the darker the green color. Published microprobe data showing the measured amounts of chromium and vanadium that produce various levels of color saturation in gems suggest that vanadium has the potential to create a strong green color as readily as chromium. Just a trace amount of chromium or vanadium oxide (less than 0.1% by weight) can cause a light green color in some gemstones, and one percent (1.0%) produces a dark green color.

To better understand how each chromophore individually affects color, we can compare examples of allochromatic gems and minerals that are colored primarily by either chromium or vanadium. In many varieties of green gems, vanadium is the dominant chromophore.

We will assume that the leading cause of color in any green gem is the coloring agent with the greatest concentration. Below is a table showing a partial list of gems that derive green color mostly from chromium or mostly from vanadium.

Chromium Dominant	Vanadium Dominant
Chrome Diopside	Tsavorite Garnet
Chrome Chalcedony	Chrome Tourmaline
Chrome Enstatite	Chrome Korneupine
Most Emeralds	Chrome Mali Garnet
Alexandrite Chrysoberyl	Chrome Sphe
Demantoid Garnet	Hydrogrossular Garnet
Uvarovite Garnet	Vanadium Chrysoberyl
Hiddenite Spodumene	Vanadium Diopside
Some Jadeite	Zoisite

Not included in this table are other gems that can be colored green by a combination of chromium and vanadium, such as kyanite, prehnite, variscite, amblygonite and vesuvianite.

Natural gemstones that are vanadium-dominant are often associated with blue-green colors. Light blue-green ‘Merelani’ grossular garnets and the light blue-green vanadium chrysoberyl derive their color primarily from vanadium, but chromium is also present.

However, a blue-green color can also be associated with chromium-dominant gems, as we see in some iron-free emeralds and some chrome chalcedony gems.



Vanadium Chrysoberyl & Chrome Chalcedony (Chromium)

Vanadium is also associated with a yellow-green color in some gemstones. As an example, vanadium diopside usually has a yellow-green color.

A green color with a slightly yellowish hue is also seen in some gems colored mostly by chromium, such as some light green hiddenite gems (spodumene).



Vanadium Diopside & Hiddenite (Spodumene)

A dark green color in natural gemstones is often associated with chromium, as we see in the voluptuous colors of chrome diopside and chrome demantoid garnet. But similar dark pure green colors can also be found in gems colored primarily by vanadium, as we see in the dazzling colors of tsavorite garnet and ‘chrome’ tourmaline.



Chrome Diopside (Chromium) & ‘Chrome’ Tourmaline (Vanadium)



Demantoid Garnet (Chromium) & Green YAG (Vanadium)

Lower concentrations of either chromium or vanadium can result in light green colors. Light green demantoid garnet colored by chromium along with iron can be indistinguishable with the naked eye from light green man-made YAG colored by vanadium.



Vanadium-Dravite



'Chrome' Tourmaline

Finally, let's look at the color of a rare example of a transparent faceted vanadium-dravite tourmaline, which is idiochromatic and colored by a high concentration of vanadium. Compared to the color of allochromatic 'chrome' tourmaline caused by much less vanadium along with some chromium, the vanadium-dravite color is slightly bluer.

Modified Green Color

All the above examples suggest that slight modifications to a green color away from pure green toward blue-green or yellow-green is linked not only to the ratio of chromium to vanadium, but also to the chemical composition and crystal structure of the host mineral in which the chromium and vanadium is found.



'Chrome' Sphene (Vanadium)

Green color from chromium and vanadium can also be modified by the presence of an additional chromophore. For example, in 'chrome' sphene (titanite), iron and/or rare earth elements can give a yellowish or brownish hue to the green body color created by vanadium and chromium.



Chrome Enstatite (Chromium)

High iron content and/or charge transfer processes involving iron may darken the tone of some gemstones colored by chromium, as we find in chrome diopside and chrome enstatite gems.



Color Change Garnet in Daylight and Incandescent Light

Variations in the light source can also modify the color of a gem. A cool LED light can modify the color of a green gem in daylight toward blue, while warm incandescent lighting can shift the green color toward yellow. In color-change gems such as alexandrite and color change garnet, the presence of chromium enables incandescent lighting to alter the color of a gem from bluish green in daylight to a warmer color such as pink, purple or red.

Chrome What?

Variety names for green gems such as 'chrome' diopside, 'chrome' chalcedony and 'chrome' demantoid are informative, as the primary cause of green color in these gems is correctly attributed to chromium. Unfortunately, the term 'chrome' is often used loosely in the trade to describe any bright green gem regardless of whether the primary coloring agent is chromium. This is partly due to marketing.

Placing the word 'chrome' in front of a gemstone name such as tourmaline adds considerable monetary value to the stone. The word 'chrome' is also used incorrectly in trade names due to general misconceptions about vanadium's role in green color. As a result, some gem varieties that are colored mostly by vanadium are referred to as 'chrome' gems.

'Chrome' tourmaline is a prime example. Chromium does contribute to the dark green color of 'chrome' tourmaline, and at times it can be the main coloring agent, but vanadium is most often the primary cause of color in 'chrome' tourmalines. A typical chrome tourmaline contains twice as much vanadium as chromium, and a more accurate trade name for this gem would be 'vanadium' tourmaline. As another example, all the dark green 'chrome' sphene gems that I have tested owe their color more to vanadium than to chromium.

The light green to dark green colors of 'chrome' kornerupine and 'chrome' Mali garnets are also due mostly to vanadium rather than to chromium. It's still common for the exquisite 'emerald' green color of tsavorite garnet to be mistakenly credited to chromium, even though research has shown that the average tsavorite garnet contains about 5 times more vanadium than chromium.

An unusual case of vanadium causing green color unexpectedly in a gem is a green 'chrome' chalcedony gem from Mexico that I purchased online.

Chromium is typically the main coloring agent found in chrome chalcedony, which is a green variety of microcrystalline quartz. Chrome chalcedony is found in a number of locations around the world, but Mexico is not a known origin.

I bought the unusual faceted gem as green chrysoprase (supposedly colored by nickel) from an online seller who prospected small rough specimens in Mexico and cut them himself. Tests I conducted in my lab show that the gem is not colored by nickel but instead by vanadium, along with a lesser amount of chromium. As far as I know, this is the first reported example of vanadium chalcedony, and the first known example of green chalcedony from Mexico.



Vanadium Chalcedony from Mexico

In Part Two, Kirk will look at ways to detect the presence chromium and vanadium using a Chelsea Filter, Dichroscope, UV Flashlight, Magnetic Wand, Blue Laser, Spectroscope and Spectrometer. He will also explore the causes of color in emerald and discuss the difference between emerald and green beryl.

All photographs by Kirk Feral



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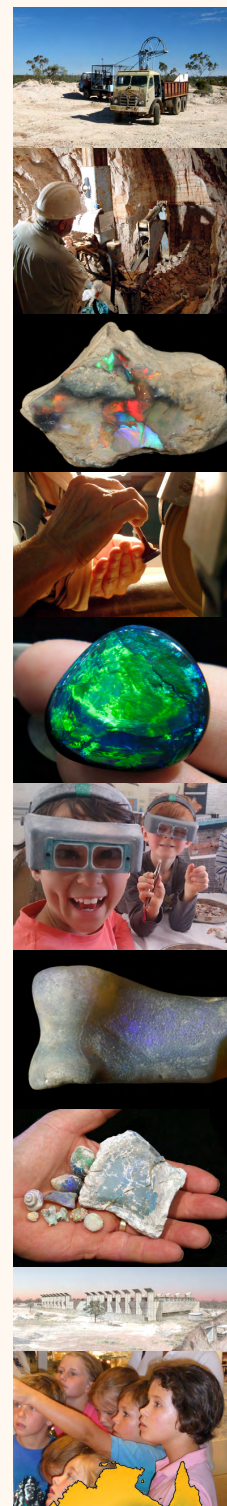
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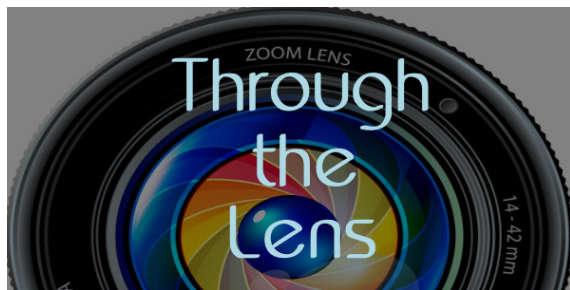
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The one that 'got away' from me was a stunning, rare 4.49 carats royal blue, natural, non-heated Brazilian 'Paraíba' tourmaline

Meet Mia Dixon



Mia Dixon

GT: Who is Mia Dixon? Tell us about your background?

MD: I was born and raised in a small town outside of Gothenburg (Göteborg), which is the 2nd largest city in Sweden. I came to the US at the age of 19 with a group of good friends to work as an Au-Pair for up to a year, and to explore southern California when we were not working. During that time, I met my husband, and decided to stay and go to college. We were married 6 years later.

GT: When did you first develop a passion for gemstone photography? Was there a defining moment when you realised this was what you wanted to do?

MD: I was kind of thrown into gem and mineral photography. Before I had children, I worked for about 2 years at Pala

International as their Administrative Assistant, and when they were born, I resigned to stay at home with them. When my youngest was about 2, I got a phone call from then in-house photographer Wimon Manorotkul (wife of Richard Hughes of Lotus Gems) asking if I was interested in coming back to Pala International as the new photographer. I didn't have any experience in photography, other than point and shoot type of shots, but she had faith in me because of other 'artistic' talent she had noticed in the past. She trained me for 2 weeks, and then I was on my own, and she was on her way back home to Thailand. To be honest, I wanted to pull my hair out many times, especially with some of the trickier mineral shots.

GT: Natural talent or acquired through study?

MD: Mostly natural, although I have taken some 3-day courses in Tucson during the gem and mineral shows. These courses were taught by Jeff Scovil and Michael Bainbridge. Robert Weldon has also given me hints, here and there, which have been greatly appreciated!

GT: Accomplished anglers always talk about the 'one that got away'. Is there one gemstone shot that has eluded you over the years?

MD: 'The one that got away' from me was a stunning, rare 4.49 carats royal blue, natural, non heated Brazilian Paraíba tourmaline. My co-worker took a photo of it before sending it to his client, who absolutely loved it. You don't see a stone like that every day, and it would have been fun to see if I could have captured its beauty. I'm going to have to have patience and see what else is around the corner...

GT: What is the one most memorable gemstone you have photographed and why?

MD: Probably the most memorable gemstone(s) I've shot were a group of bicolored tourmalines from the Himalaya mine. It was the first time I incorporated something other

than just the gemstones into the photograph. I was walking into work one morning and saw these really pretty berries on one of the bushes, and thought they looked just like our tourmalines, color wise. To me it makes an interesting composition with the different textures and similar colors.

GT: Is there still a place for analog film in the world of gem photography?

MD: Digital photography seems to be around to stay; I don't think the majority of photographers would want to go back to using analog film. I can't imagine doing that in this fast-paced world, where everything is needed an hour before it was even requested from you.

GT: Are you a purist or do you use software, such as Photoshop, to bring out the best in your photographs?

MD: I have my camera tethered to the computer via Lightroom, so I usually adjust the contrast and sharpness there, and then I open up the image in Photoshop and remove dust that I might have missed before I put the stone on the glass. I try to not use it too much, but sometimes it is necessary to adjust the color so it will look true to itself. I'm not sure why but sometimes it seems like the camera alters the actual color, so it needs to be adjusted. Greens seem to be the trickiest with the problem being that the color has changed.

GT: Guitarists are always asked about the equipment they use and the ones they most prefer. What is your camera of choice and why?

MD: When I started photographing in 2008, I used a Nikon D300, which was great but for the last, I would say 8 years, I've been using a Nikon D800 with a Sigma 150 mm lens and it has been working out so I'm sticking with it a while longer.

GT: Where do you see the future of gemmology ten years from now?

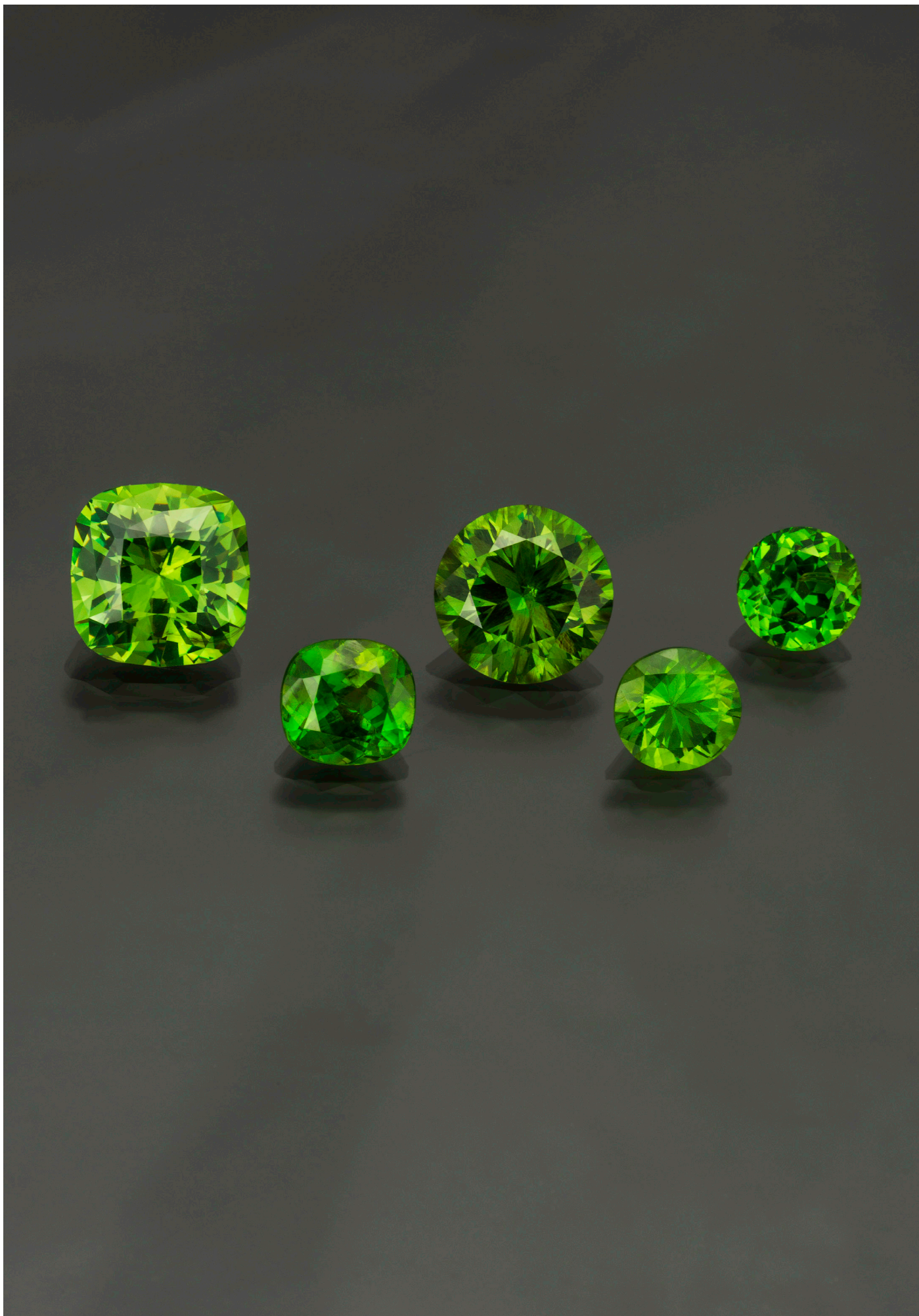
MD: More state-of-the art testing tools will most likely be created thus making it easier to find out if it is natural or treated in one way or another. If the Raman spectroscopy goes way down in price, and gets smaller, which credible sources say is about to happen, it would greatly help gemologists identify stones correctly without having to send them out to a lab. I also predict that there will be a couple of new gem localities for new gem varieties. A couple of years ago there was a new find of clean and beautiful green sphene. It was discovered at the Nyadire Mine in Mashonaland, East Province, Zimbabwe.

GT: If we were sitting here a year from now celebrating what a great year it's been for Mia Dixon professionally, what would you say was the reason?

MD: My wish is that I've learned some new and creative ways of shooting. There is always room for improvement, and I enjoy the process of learning and seeing the growth happen. I am also toying with the idea of doing some freelance work in addition to my work at Pala.



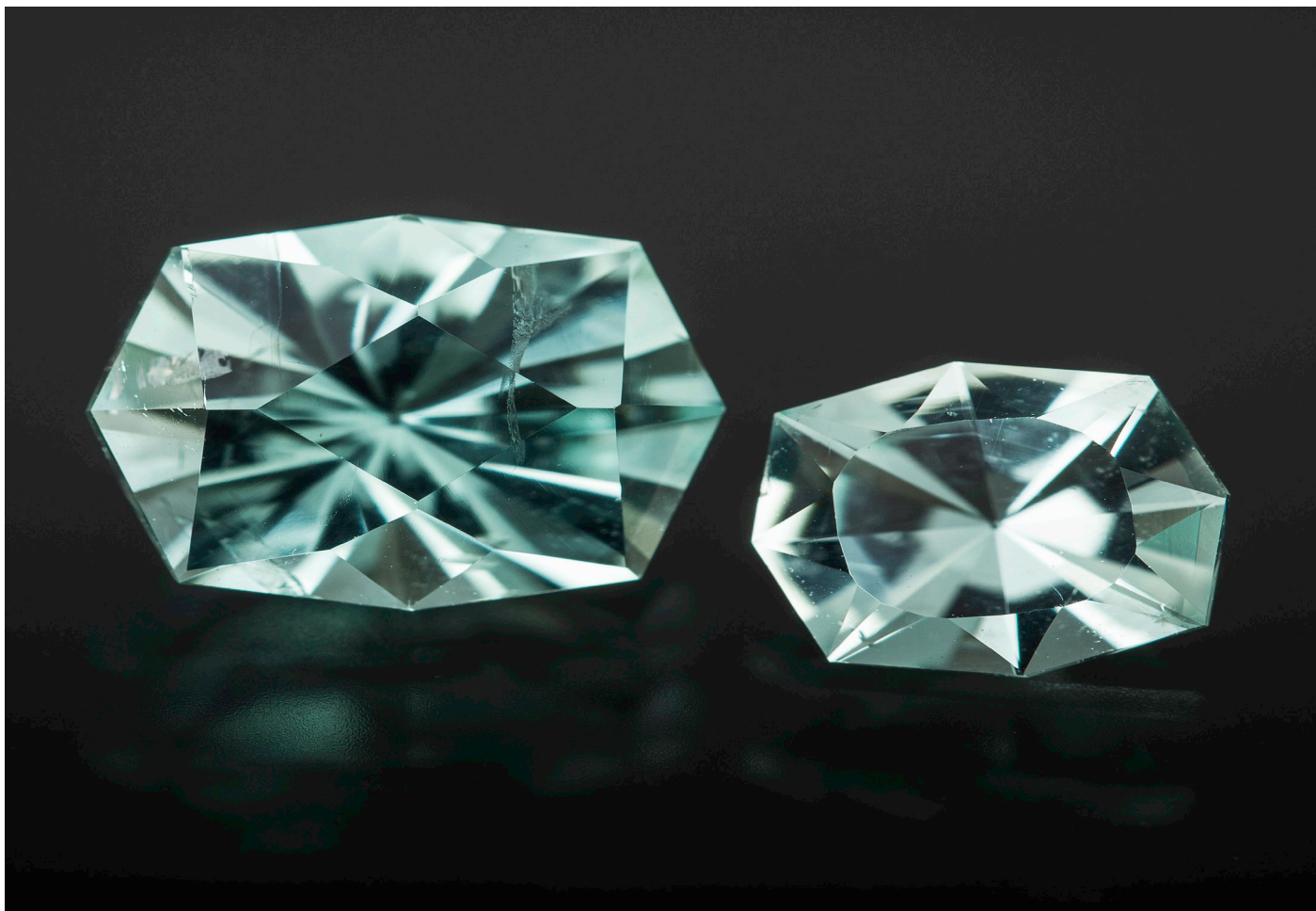
Tanzanite, Pink Tourmaline and Diamond Pendant and Ring made by Ilka Bahn (Photo by Mia Dixon)



Russian Demantoid Garnets (Left to Right 5.23cts, 2.09cts, 3.89cts, 1.68cts & 1.66cts) (Photo by Mia Dixon)



Burmese Ruby (2.72cts), Crystal (6.69cts), Sri Lanka Blue Sapphire Crystal (22.39cts), Sri Lanka Blue Sapphire (11.67cts) (Photo by Mia Dixon)



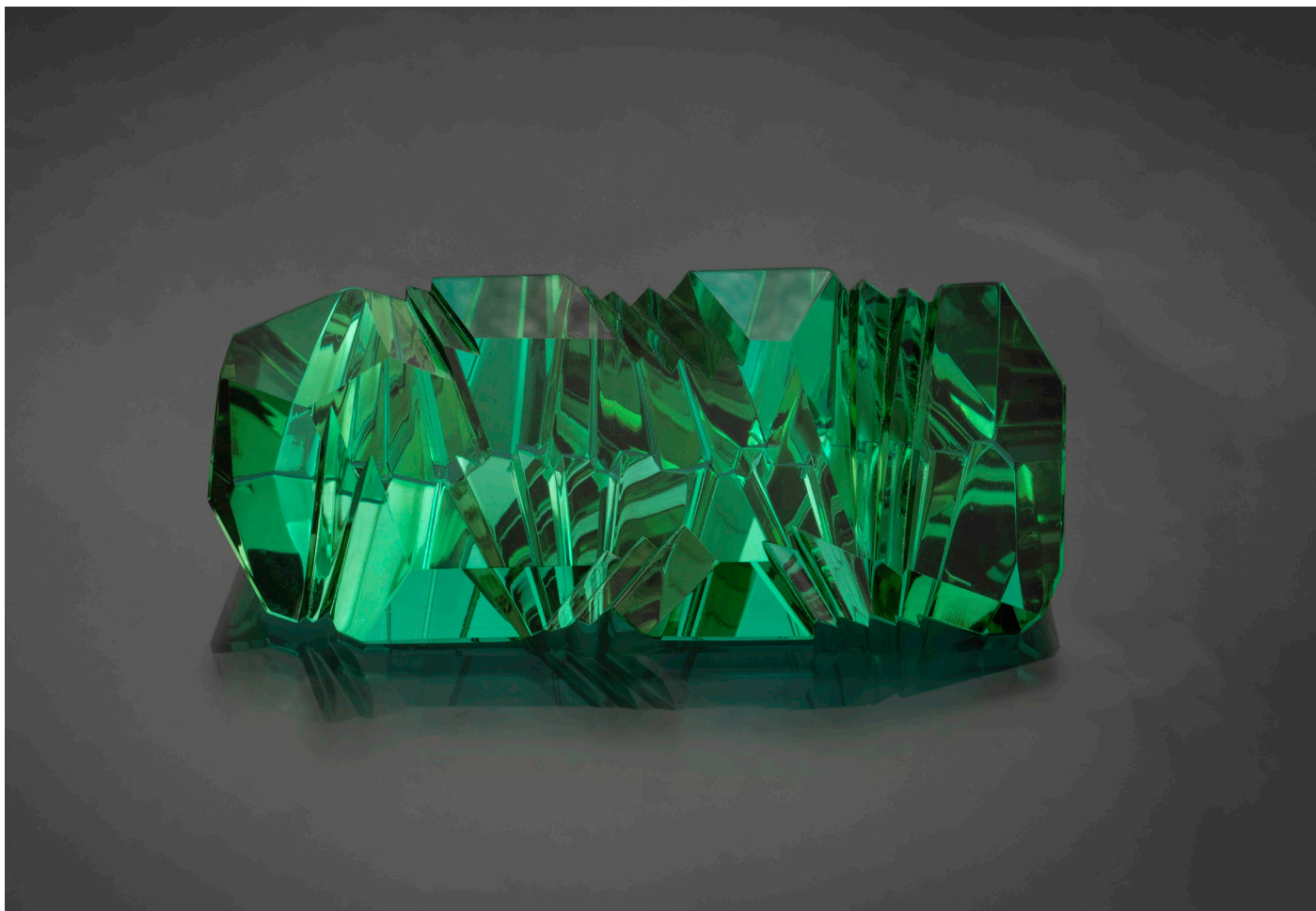
Phosphophyllites (Bolivia) - 1.52cts & 0.61cts (Photo by Mia Dixon)



Spessartite Garnet (Nigeria) - 33.48 carats (Photo by Mia Dixon)



Sphene (Zimbabwe) - 9.39 carats (Photo by Mia Dixon)



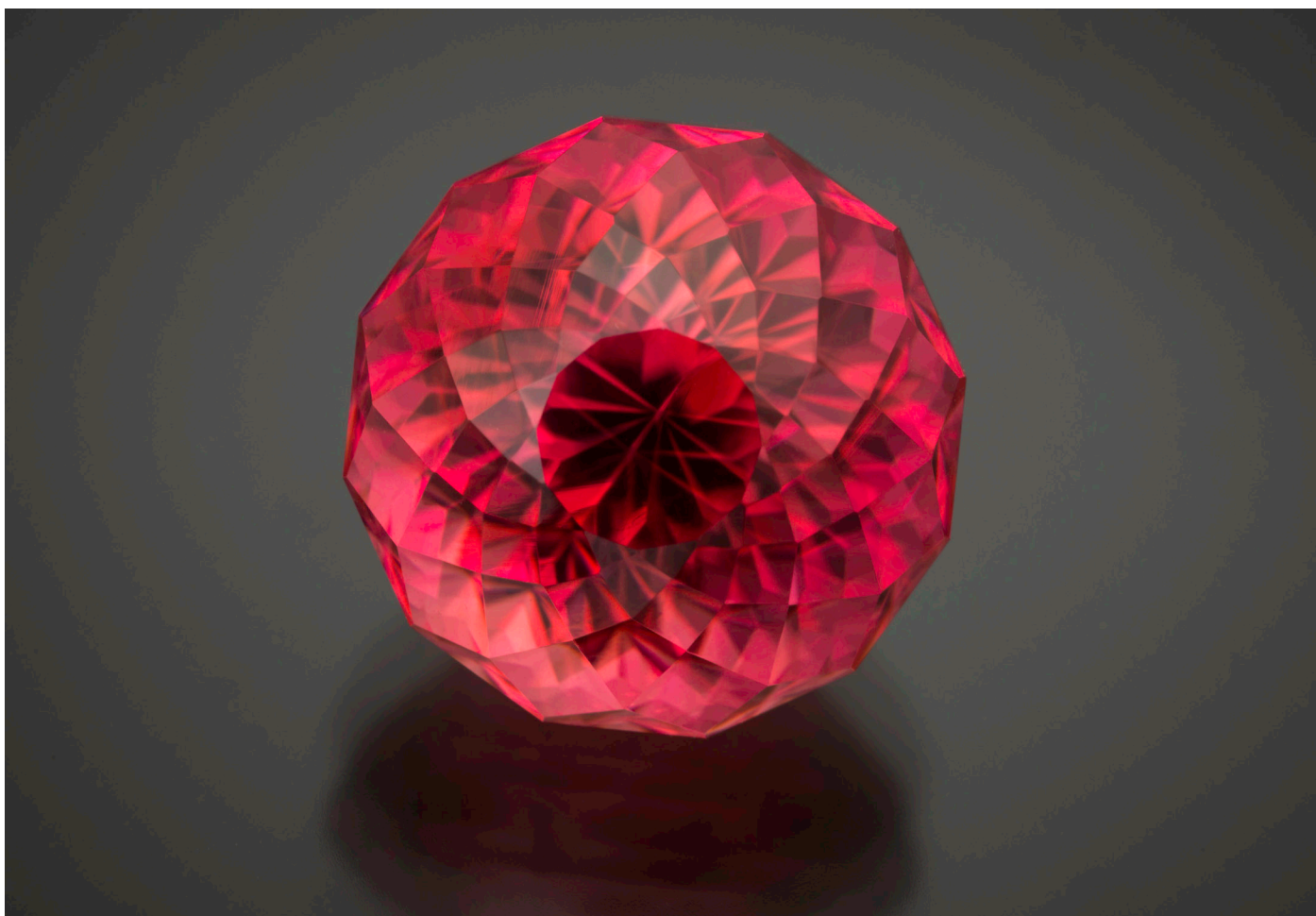
'Envy - Reflections & Perspectives I' Tourmaline (Brazil) - 113.90 carats by Munsteiner measuring 5.0cm x 2.3cm x 1.5cm (Photo by Mia Dixon)



Pink Tourmaline (Queen Mine) 10.68 carats surrounded by Diamonds. Pendant created by Ilka Bahn (Photo by Mia Dixon)



Golden Scheelite (China) - 96.41 carats (Photo by Mia Dixon)



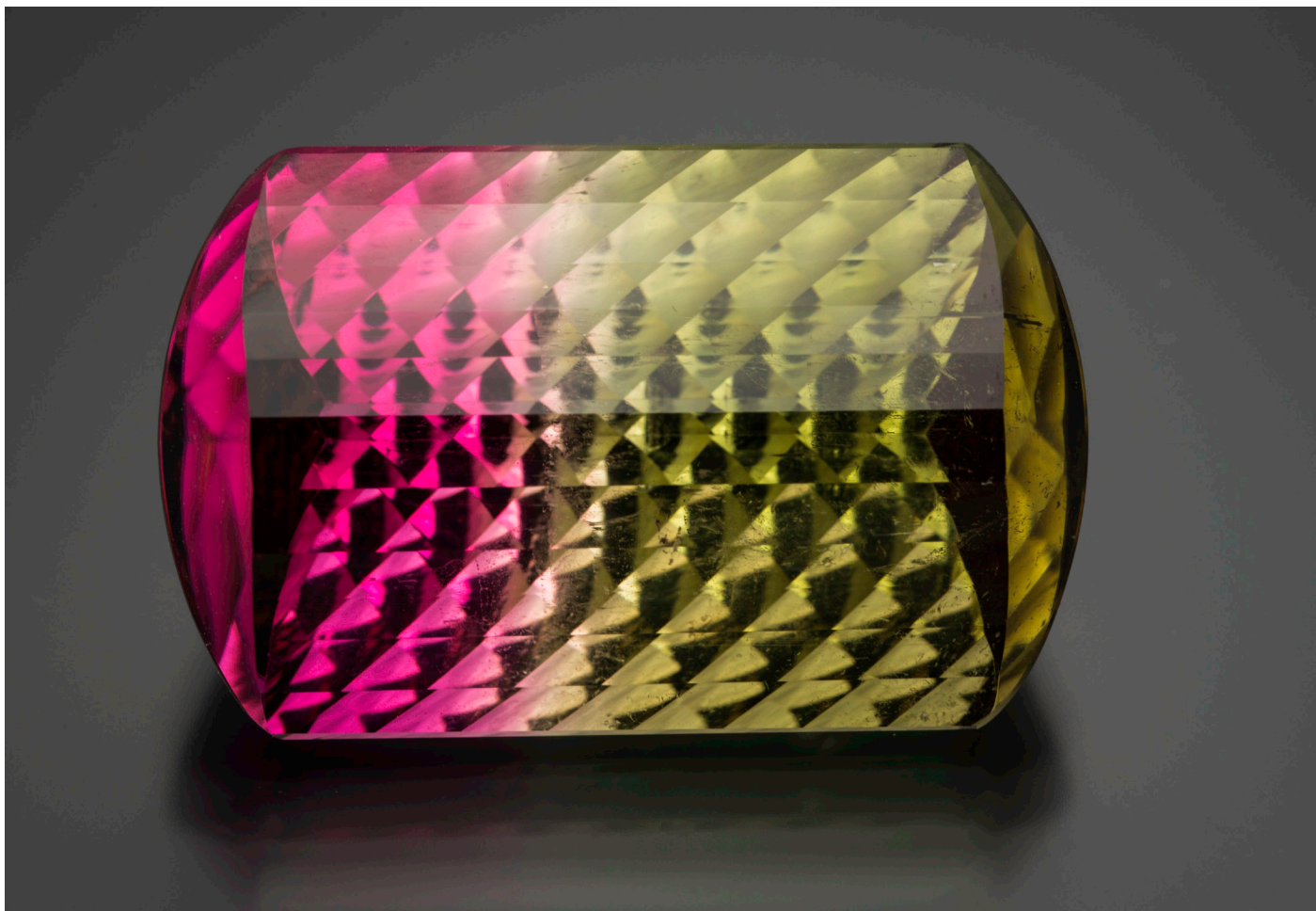
Rhodochrosite (South Africa) - 9.34 carats (Photo by Mia Dixon)



Strawberry Vine (12cm x 11cm), Large Himalaya Mine Tourmaline Strawberry (4cm x 3.5cm), Light Green and Small Himalaya Mine Bi-Colour Tourmaline Strawberry, Brazilian Tourmaline Dark Green Leaves, Quartz Vase (9.5cm x 7cm) Carved by Daniella (Photo by Mia Dixon)



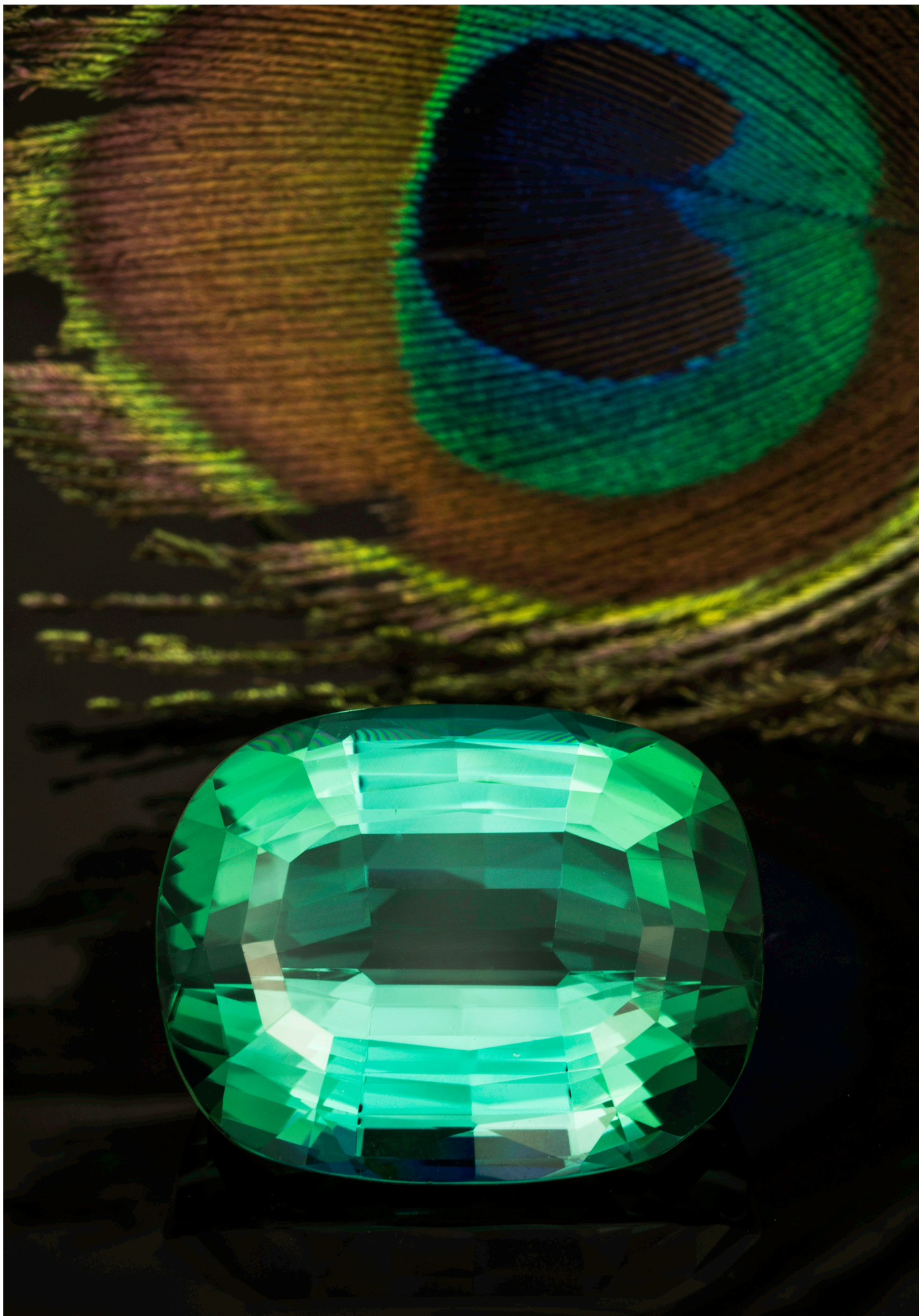
Bi-Colour Tourmalines (Himalaya Mine) - 9.95 carats (27mm x 7mm) (Front) Matched Pair 22.20 carats (16.9mm x 9.2 mm) (Photo by Mia Dixon)



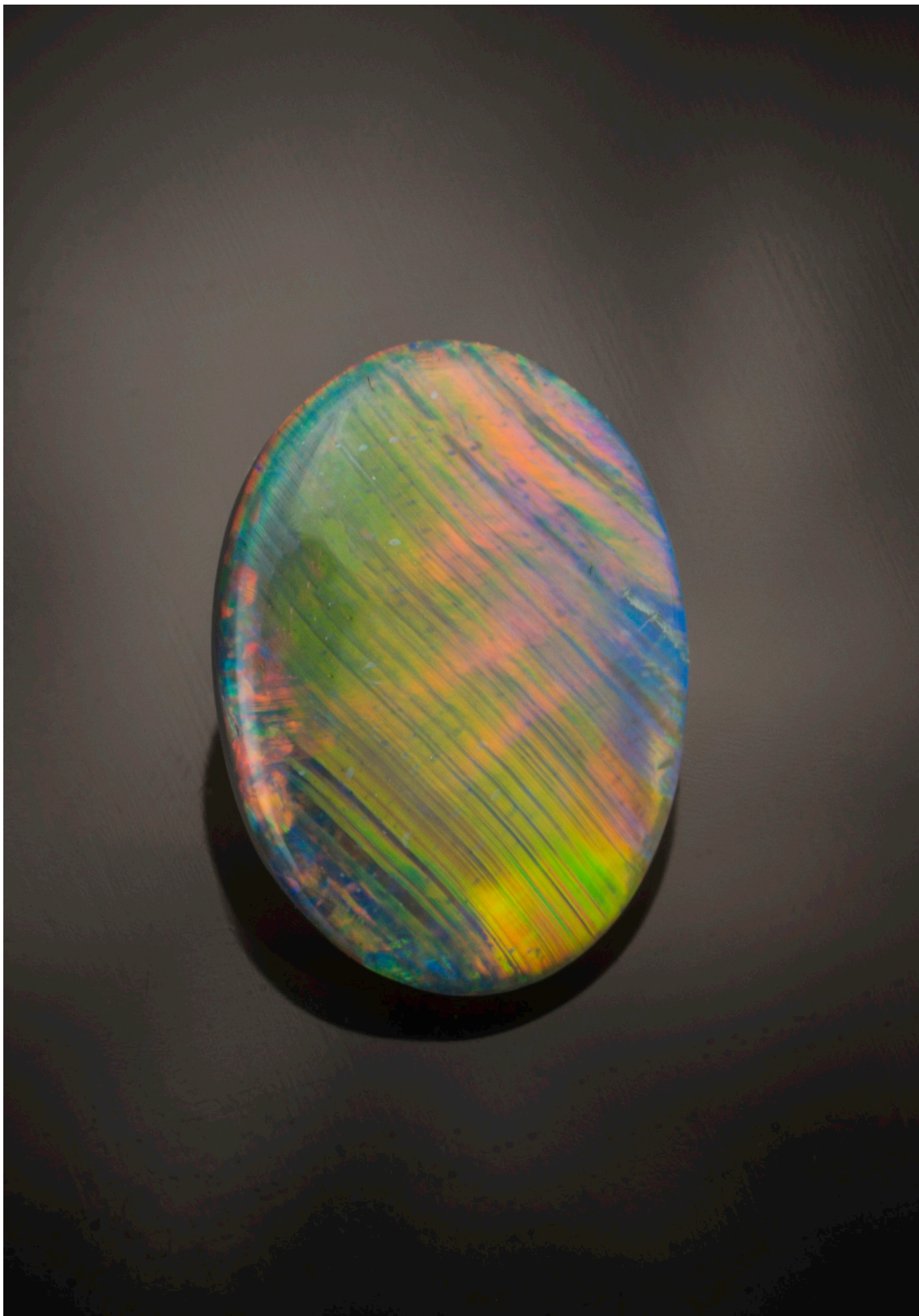
Fancy Cut Tri-Colour Tourmaline (Afghanistan) - 39.00 carats (Photo by Mia Dixon)



Fire Agate (Mexico) - 4.59 carats (Photo by Mia Dixon)



Green Tourmaline (Brazil) - 27.63 carats (Photo by Mia Dixon)



Opal (Australia) - 1.47 carats (Photo by Mia Dixon)

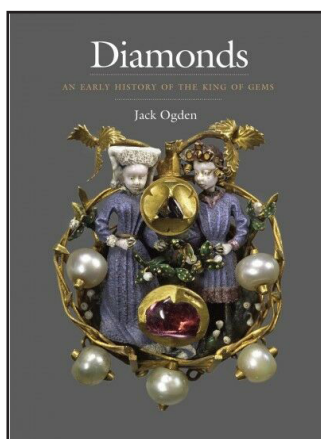


Danburite - 13.83 carats (Photo by Mia Dixon)

Literary Speaking

Expand Your Mind

In this issue Richard W. Wise looks at two books; *Diamonds, An Early History Of The King Of Gems* by Jack Ogden & *Rock Creek Sapphires, A Kaleidoscope of Color* by Jeff R. Hapeman



In his new book, *Diamonds, An Early History Of The King Of Gems*, Jack Ogden discusses many of the stories and debunks several of the myths associated with diamond history. He raises some interesting questions and answers some which have puzzled scholars for many years. For example, in the judgement of clarity in diamonds, how old is the 10X standard? Is it an ancient standard or one introduced in modern times to increase the perception of rarity (Wise, 2016)? Did the ancients possess magnifying lenses? With striking erudition, Ogden cites a whole range of sources, Greek, Indian and European, ancient and medieval to provide a definitive answer to this question.

It has become popular to debunk the diamond engagement tradition. Some contemporary writers (Epstein, 1982) have claimed that the Western tradition of presenting a diamond engagement ring to one's intended was essentially a creation of DeBeers' advertising agency, N. W. Ayers. Ogden takes issue with this claim and though there are few extant examples, he supplements with a solid circumstantial case that diamonds have been a symbol of love since the Roman period.

Ogden next introduces new information into the discussion of the history of diamond cutting. In his comprehensive *History Of Diamond Production and The Diamond Trade* (1983), the German scholar, Godehard Lenzen, makes a distinction between the shaping and polishing of diamonds. He suggests that diamonds were being polished in Europe as early as the 14th century. Of the actual shaping (cutting) he can find no evidence of its existence prior to the 16th century.

Citing the price list of a Jewish merchant active in Venice in 1403 that includes prices for both cut and uncut diamonds, Ogden is able to push that date back by more than a century. Using illustrations with etymological evidence, the author builds a strong case that diamonds were being faceted in the second half of the 14th century and proposes that the technology was well understood as early as 1300.

The five chapters that follow are devoted to in-depth discussions of the historical and technological development of diamond design. Beginning with the simple point cut he guides us through the evolution and increasing complexity of cutting, from the table cut through the rose and brilliant cuts.

Chapter 11 contains a fascinating discussion of quality grading and the pricing of diamonds from earliest times. Quoting multiple sources Ogden treats the reader to an exacting, and at times bewildering discussion of weights and measures. Not satisfied with the standard explication of carats and carobs, the author informs the reader of the relative weights of the mithqal, the dirham and the gumja, along with the average weight of a peppercorn and how these relate to the size of a given diamond and the equivalent weight of gold. For those who love, as I do, reading translations of original sources, particularly older ones, this discussion will open many doors.

Ogden considers The Indian Diamond Mines; Chapter 12, and an interesting historical discussion of the various diamond markets in the sub-continent in Chapter 13. Diamond cutting in India is covered in Chapter 14 and the eclipse of India and the rise of Brazil as the world's major diamond producer in Chapter 15.

Dr. Ogden is also the author of *Jewellery of the Ancient World* (1962), an excellent study of ancient jewelry making technology. He is one of a small cadre of top-notch scholars researching and writing in the gem and jewelry field. For those interested in diamond history and diamond cutting, *Diamonds, An Early History of the King of Gems*, is an important update to the existing literature and a necessary addition to your library.

Price: \$ 40 USD (408 Pages)



After several charming shots of the Sapphire Mountain area, the author begins with an excellent overview, illustrating, in words and pictures, modern mining operations at the Rock Creek deposits located outside Phillipsburg, Montana. This area, discovered in 1892 and worked initially to provide 'jewels' to the Swiss watch industry, was purchased and has been worked since 2014 by Potentate Mining LLC.

Hapeman's photographs are professional quality and that's a good thing because Rock Creek Sapphires, is primarily a picture book. In the early 1990s, I served as a consultant to American Gem Corporation, the former owners of the Rock Creek deposit. I was able to view literally thousands of carats

of natural and heat treated stones mined at Gem Mountain, just above the west fork of Rock Creek. I can state with some authority that the stones the author presents, cut mainly by himself, are some of the best of the best ever sourced from this area.

The book includes sections featuring 'Blue and Teal Sapphires', 'Orange and Yellow Sapphires', along with sections on Rock Creek ruby, pink and purple, phenomenal and unusual sapphire. The volume concludes with a useful section depicting some lovely microphotographs of inclusion patterns typical of untreated sapphires from Rock Creek.

For sapphire lovers, this book is a must have, but better act quickly, this is a very limited production with only 750 copies printed and just 408 left last time I looked. Copies are available on the author's website.

Price: \$ 79 USD (83 Pages)

Praise for the 1st Edition:

"A masterpiece, a tour de force. My recommendation, buy this book."
— Canadian Jeweler & Orchid

"The second edition builds substantially on the first edition...breaks new ground in the discussion of blue-white diamonds and includes perhaps the most comprehensive and sensitive overview of the aesthetics of jade to be found in the English language."
— Benjamin Zucker

Secrets of the Gem Trade:

The Connoisseur's Guide to Precious Gemstones

Second Edition

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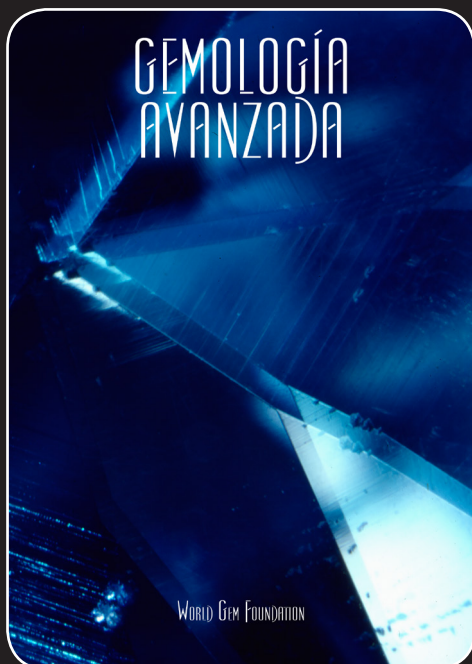
11 New Chapters.

5 New Introductory Essays.

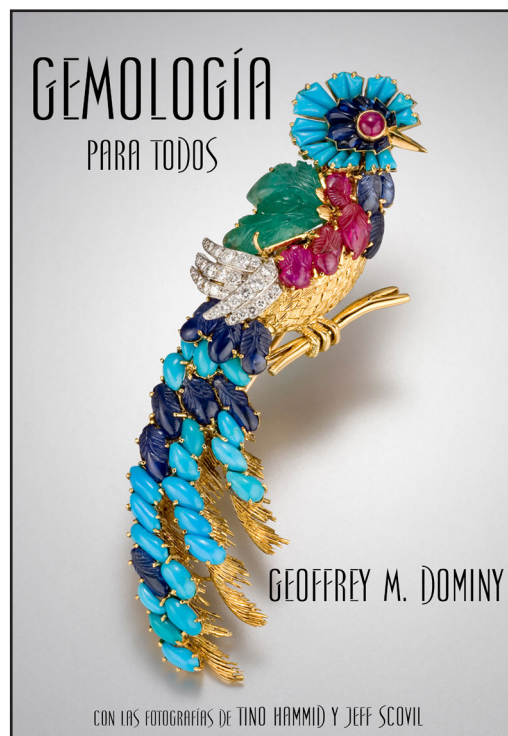
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Studying Gemmology with the World Gem Foundation

There's an expression 'different strokes for different folks' and this is certainly true in the case of gemmology. We are fortunate to work in an extremely diverse industry; one that provides unlimited opportunities in a broad range of disciplines.

Some people want to become a professional gemmologist; to forge a career for themselves working with gemstones. At the World Gem Foundation, gemmology is not just a job, it's a profession. This is why we opted for the 'Career Gemmologist' designation. We not only want to raise the level of consciousness with consumers but also within our industry. An awareness that gemmology is a science that demands a high level of theoretical knowledge and practical experience.

At the same token, we also understand that not everyone wants to become a fully fledged gemmologist. Many choose to specialise in a particular area, such as diamonds or coloured gemstones. To recognise this, we introduced two new 'Diploma' programs (Diamond Professional and Coloured Gemstone Professional) in 2018.

But what about gemmologists who may have completed their studies five, ten, fifteen or twenty years ago? Since gemmology is constantly evolving, it is important to continually upgrade your knowledge. You simply cannot afford to become complacent. One minute you may be 'up to speed', the next completely 'out of sync'. Each year brings new treatments and enhancements, new lab-created gemstones and new techniques to identify them. It is not the certificate that hangs on your wall that defines who you are as a gemmologist but the knowledge you possess. Our courses can be taken collectively or independent of each other, allowing our students to customise their own personal development programs based on their own specific needs.

Finally, there are many people who share a passion for gemstones but don't necessarily want to enrol in a gemmological program, they simply want to augment their existing knowledge and upgrade their level of understanding.

Regardless of your motivation to expand your knowledge, the World Gem Foundation has a variety of courses and programs that can help you reach your goal.

Career Gemmologist Program

For students wishing to pursue a career in gemmology, our 'Career Gemmologist' program has been especially designed to give you the knowledge and experience required to work as a professional gemmologist. The World Gem Foundation and our affiliated gem academies offer you two options to earn your Career Gemmologist Diploma with our Gemmology Seven/ Eleven programs.

Gemmology Seven

This option allows you to complete the entire theoretical requirements by enrolling in our Career Gemmology course (78 lessons) and completing the five practical workshops (Gem Identification #1, Gem Identification #2, Diamond Grading and Lab-created Diamonds, Coloured Gemstone Grading #1 and Lab-created and Treated Gems) and our 100 hour online Coloured Gemstone Grading course.

The theoretical component covers the chemical nature of gemstones, their physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction and reflection, the refractometer, optical character and sign, dispersion, reflectivity meters, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification and thermal conductivity.

From there we move into the most challenging and fluid areas of gemmology; imitation and composite gemstones, lab-created gemstones and the treatment and enhancement of gems.

In the lessons pertaining to lab-created gemstones you will not only learn about the various methods used to manufacture lab-created gemstones (including Verneuil Flame-Fusion, Czochralski Pulling Method, Flux Melt Method, the Hydrothermal Method, Skull Crucible, Zone Melt, Horizontally Oriented Crystallization, the Sublimation Method, and the Modified Stober Method) but also the unique identifying features that allow us to separate them from their natural counterparts.

The use of treatments and enhancements is both demanding and depending on who you talk to, highly controversial. Here we look at not only the techniques used to treat and enhance gemstones (heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, HPHT, quench-crackling, surface modifications, coatings and foil backs, laser drilling and irradiation) but also how they can be detected. We also look at the advanced gem testing techniques that are often needed to identify many of these treatments.

The course then takes a slightly different direction, focusing on the identification of gemstones including the tests that are commonly used to identify them and an in-depth look at each of the ten gemstone groupings based on colour and transparency (colourless or white, red, pink, orange,

yellow, blue, green, violet or purple, brown, black or grey). These lessons include the important varieties and species of gemstones that commonly occur within each colour grouping, how to distinguish gemstones that are commonly confused with each other (i.e. aquamarine and blue topaz, emerald and chrome green tourmaline, diamond and lab-created moissanite) or gemstones that have physical and optical properties that are similar (i.e. amethyst quartz and purple scapolite) to each other. This section also includes gemstones that either exhibit optical phenomena (i.e. asterism or chatoyancy) or are unusual by nature.

The next section looks specifically at diamonds, their physical properties, geology, localities, principle mines, crystal system, chemical composition and classification. You will also find lessons dedicated to fancy coloured diamonds, the causes of colour, absorption spectra, inclusions, fluorescence, mining, gem identification, methods of synthesis (including HPHT, CVD, Detonation and Ultrasonic Cavitation), common treatments and enhancements and a comprehensive examination of the 4 C's (colour, clarity, cut and carat weight) and how they are measured and assessed. The lesson on 'Cut' compares some of the most important and recognized 'Cut' grading systems used today including those pioneered by the Gemological Institute of America (GIA), the American Gem Society (AGS), Hoge Raad voor Diamant (HRD), the International Gemological Institute (IGI), the European Gemological Laboratory (EGL) and the Accredited Gem Appraisers (AGA).

The final twenty-nine lessons (29) are devoted to coloured gemstones and covers their physical properties, geology, localities, crystal system, chemical composition and causes of colour, varieties, absorption spectra, pleochroism, inclusions, fluorescence, gem identification, synthesis, common treatments and enhancements, and care guidelines. Gemstones covered include corundum, beryl, chrysoberyl, spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, spodumene, feldspars, iolite, andalusite, diopside, apatite, and organic gems (pearls, coral, jet, ivory, and amber). You will also learn about the various colour grading systems currently used (GIA, Gemewizard, GemDialogue and the World of Color) including how to accurately describe colour based on hue, tone and saturation, the clarity classification of gemstones, how cut is assessed, opal, jadeite and pearl grading, and how to estimate the weight of 'mounted' stones.

The study of gemmology simply would not be complete without a comprehensive program of practical instruction. This involves five practical workshops (Gem Identification #1 & #2, Diamond Grading and Lab-created Diamonds, Lab-created and Treated Gems and Coloured Gemstone Grading #1) totalling twenty-eight days of in-class instruction and a 100 hour online Coloured Gemstone Grading course where you will work with the Gemewizard Colour Grading system.

Gemmology Eleven

While the information is the same, the theoretical portion of this program is divided into five free-standing courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones). This option allows you to take each course separately giving you greater flexibility in terms of time and how you can pay for the courses.

Like the 'Gemmology Seven' program, there are five practical workshops and one 100 hour online course.

Diamond Professional Program

Designed specifically for those engaged in the diamond trade, this program covers the same theoretical information covered in our 'Diamonds' course plus our eight-day Diamond Grading and Lab-created Workshop.

Coloured Gemstone Professional Program

If your area of expertise is coloured gemstones, this program is ideally suited for you. The CGP program involves the completion of four theoretical courses (Basic Gemmology, Advanced Gemmology, Gem Identification and Coloured Gemstones) plus our two five-day practical Gem Identification workshops, our five-day Coloured Gemstone Grading #1 workshop, our five-day Lab-created and Treated Gems workshop plus our 100 hour online Coloured Gemstone Grading #2 course.

Courses in Other Languages

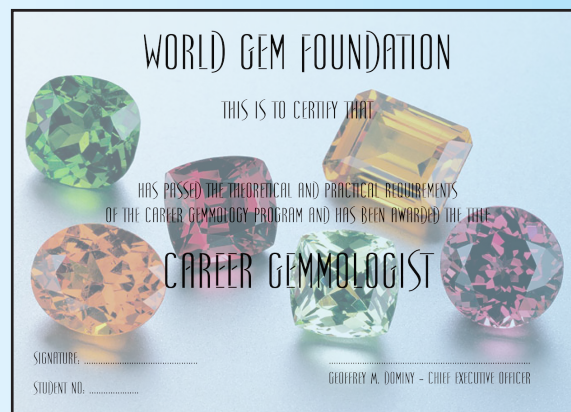
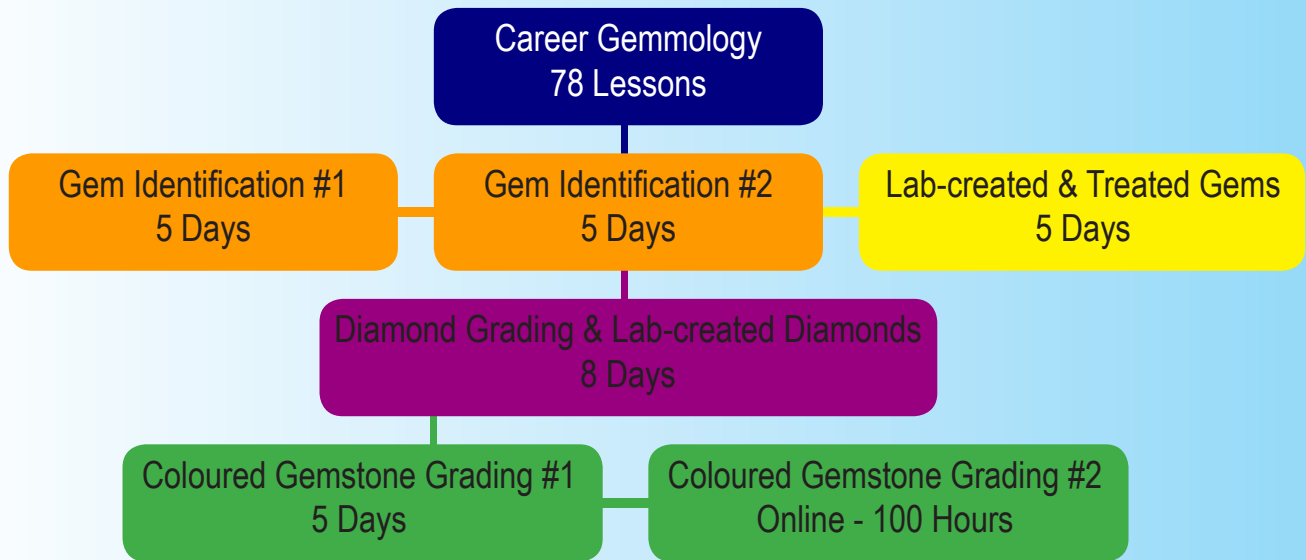
We are currently translating all of our 'Diploma' program courses into Spanish and Chinese to meet the needs of our Spanish and Chinese speaking students.

Currently our Gemología Básica (Basic Gemmology) and Gemología Avanzada are available in Spanish in digital, print and also online.

General Interest Courses

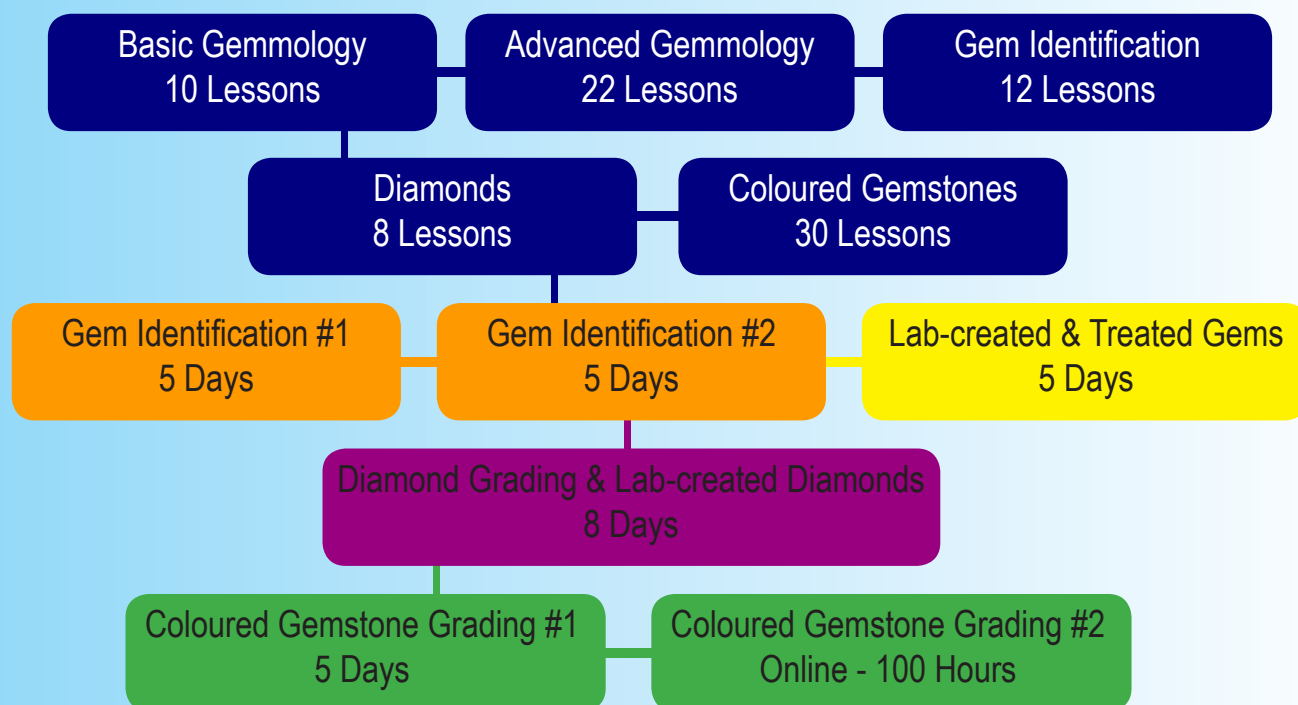
For those interested in gemstones but not wishing to take our 'Diploma' programs, all of our theory courses can be taken independently without prerequisites. In addition to the six theoretical courses (Career Gemmology, Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones) that make up our Career Gemmologist, Diamond Professional and Coloured Gemstone Professional 'Diploma' programs, we also offer three 'General Interest' courses (Rubies, Sapphires and Emeralds, Opals and Jade and Organic Gems).

GEMMOLOGY SEVEN PROGRAM



Career Gemmology Seven	Digital Fees			Printed Fees		
Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Career Gemmology (Theory)	1400	1100	1600	1570	1235	1795
Gem Identification #1	500	400	550	500	400	550
Gem Identification #2	500	400	550	500	400	550
Coloured Gemstone Grading #1	500	400	550	500	400	550
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000
Lab-created & Treated Gems	500	400	550	500	400	550
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	6400	5100	7230	6570	5235	7425

GEMMOLOGY ELEVEN PROGRAM

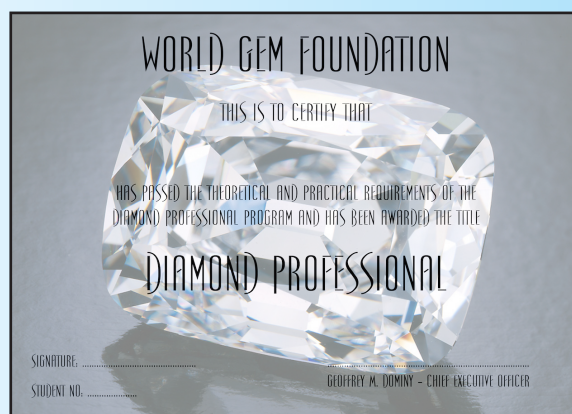


Career Gemmology Eleven				Digital Fees			Printed Fees		
Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Basic Gemmology (Theory)	200	150	225	235	180	265			
Advanced Gemmology (Theory)	400	300	450	430	325	485			
Gem Identification (Theory)	225	175	250	255	200	285			
Diamonds (Theory)	225	175	250	255	200	285			
Coloured Gemstones (Theory)	500	400	550	565	450	625			
Gem Identification #1	500	400	550	500	400	550			
Gem Identification #2	500	400	550	500	400	550			
Coloured Gemstone Grading #1	500	400	550	500	400	550			
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150			
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000			
Lab-created & Treated Gems	500	400	550	500	400	550			
Examinations Fees (Final Exam)	250	200	280	250	200	280			
Total Cost	6550	5200	7355	6740	5355	7575			

DIAMOND PROFESSIONAL

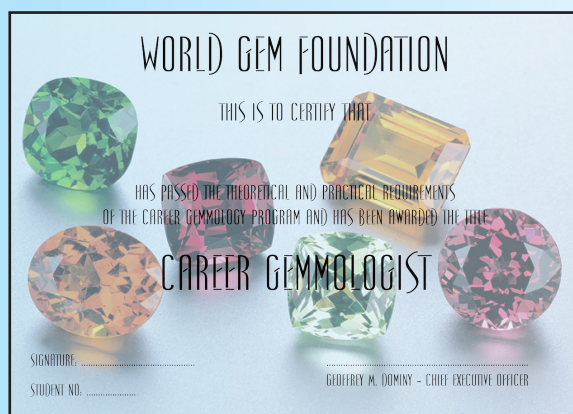
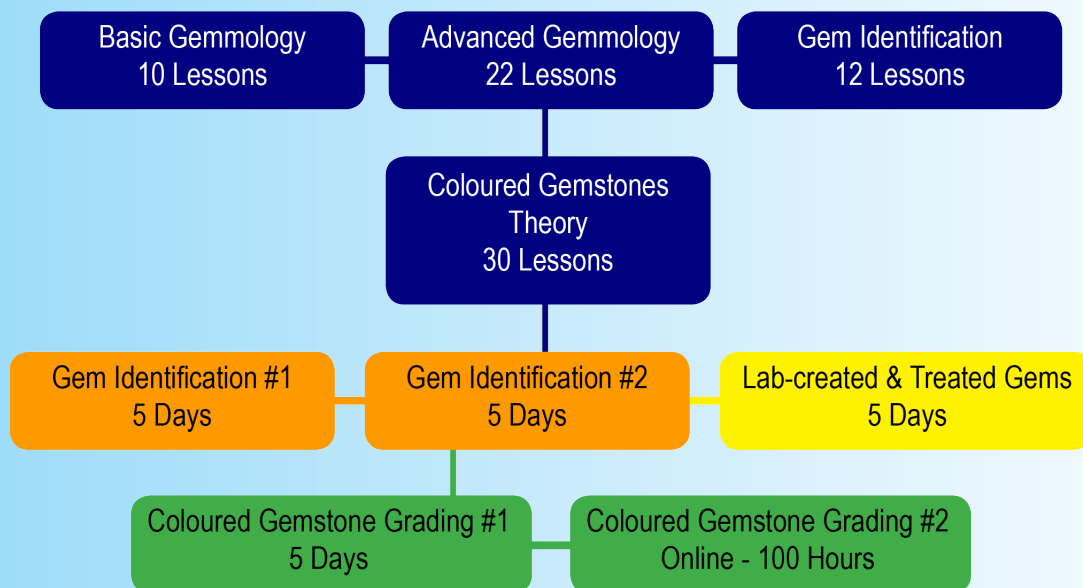
Diamonds
Theory
8 Lessons

Diamond Grading & Lab-created Diamonds
Practical Workshop
8 Days



Diamond Professional	Digital Fees			Printed Fees		
Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Diamonds (Theory)	225	175	250	255	200	285
Diamond Grading/Lab-created Diamonds	1750	1400	2000	1750	1400	2000
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	2225	1775	2530	2255	1800	2565

COLOURED GEMSTONE PROFESSIONAL



Coloured Gemstone Professional

Digital Fees

Printed Fees

Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Basic Gemmology (Theory)	200	150	225	235	180	265
Advanced Gemmology (Theory)	400	300	450	430	325	485
Gem Identification (Theory)	225	175	250	255	200	285
Coloured Gemstones (Theory)	500	400	550	565	450	625
Gem Identification #1	500	400	550	500	400	550
Gem Identification #2	500	400	550	500	400	550
Coloured Gemstone Grading #1	500	400	550	500	400	550
Coloured Gemstone Grading #2	1000	800	1150	1000	800	1150
Lab-created & Treated Gems	500	400	550	500	400	550
Examinations Fees (Final Exam)	250	200	280	250	200	280
Total Cost	4575	3625	5105	4735	3755	5290

Rubies, Sapphires & Emeralds

This course focuses on three coloured gemstones (rubies, sapphires and emeralds) that individually and collectively are considered the cornerstones of the coloured gemstone trade. Lessons include a complete overview of their physical and optical properties, principal sources, mining, how they can be identified from gemstones that can be deceptively similar in appearance and their lab-created counterparts, common treatments and enhancements, pricing guidelines, what constitutes the best quality and how to properly care for them.

Opals and Jade

This course looks at two of the most fascinating and complex gemstones in the science of gemmology. The lessons on opal cover their physical and optical properties, their geology, localities, crystal system, chemical composition and classification, varieties, cause of colour, absorption spectra and pleochroism, inclusions, fluorescence, principal mines, opal mining in Australia, opal grading, synthesis of opal, gem identification, common treatments and enhancements, opal doublets and triplets, cleaning and care and pricing.

The section on jade follows a similar format with lessons covering their physical and optical properties, their geology, localities, crystal system, chemical composition, absorption spectra and pleochroism, inclusions, fluorescence, mining, principal mines, evaluating the rough, jadeite cutting, jadeite nomenclature, grading jadeite, synthesis of jadeite, gem identification, common treatments and enhancements, cleaning and care and pricing.

Organic Gems

This course explores a very select group of gemstones (coral, jet, amber, ivory and pearls), formed through organic processes rather than through geological forces deep within the earth's surface. Lessons cover their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, causes of colour, common inclusions and internal characteristics, fluorescence, pearl grading criteria, methods of synthesis, gem identification, common treatments and enhancements, and cleaning and care instructions.

Online Tutoring

While clearly the ideal way to learn a particular subject is with one-on-one tutoring, we appreciate that this is difficult when you enrol in a long distance study program.

Fortunately, new distance learning technologies are changing. Now teachers can connect with their students virtually using a variety of virtual tutoring tools, such as Skype.

The chart below outlines the number of online tutoring hours that are included in your course price. If you require more online instructional tutoring, please contact your education coordinator to discuss availability and pricing.

Course Name	Hours
Basic Gemmology - Theory	2
Advanced Gemmology - Theory	4
Gem Identification - Theory	2
Diamonds - Theory	2
Coloured Gemstones - Theory	5
Career Gemmology - Theory	14

We strongly suggest that you contact your instructor beforehand by email with your questions so that you will derive maximum benefit from your online session. Please remember that these sessions are designed to provide you with 'coaching' rather than direct instruction.

Course Fees

Fees charged by the individual gem academies are charged in the prevailing currency for that particular area (i.e. Euros in Europe, Pounds Sterling in Britain). Please note that shipping charges apply to any courses provided in print.

Practical Workshops

Gem Identification #1



Dates: May 15th to 18th, 2019

Venue: Naarden, Holland

Please Note: To accommodate overseas students and meet the 30 hour requirement, this workshop will be held over four days (7 1/2 hours per day).

Course Cost € 500

[Reserve Your Place Now](#)

This five day (30 hour) practical workshop focuses on the study and identification of six colour groupings (colourless/white, red, pink, orange, yellow and green) and basic crystallography. Gemstones covered in this workshop include:

Natural Diamond, Natural Ruby, Natural Sapphire, Emerald, Beryl, Garnets (Spessartite, Almandite Rhodolite, Pyrope, Colour Change, Hessonite, Demantoid, Tsavorite and Grossular), Spinel, Tourmaline, Topaz, Beryl, Quartz, Zircon, Alexandrite, Chrysoberyl, Apatite, Kunzite, Sunstone, Sphalerite, Sphene, Phenakite, Brazilianite, Scapolite, Hiddenite, Danburite, Benitoite, Diaspore, Epidote, Kyanite, Idocrase, Sinhalite, Diopside, Korerupine, Enstatite, Euclase, Andalusite, Ekanite, Idocrase, Moldavite, Obsidian, Chrome Chalcedony, Amazonite, Jadeite, Nephrite, Chalcedony, Dyed Jasper, Chrysoprase, Maw-Sit Sit, Rhodonite, Rhodochrosite, Amber, Coral, Fire Opal, Lab-created Moissanite, Cubic Zirconia, GGG, YAG, Lab-created Rutile, Strontium Titanate, Lithium Niobate, Lab-created Spinel, Glass, Lab-created Alexandrite, Garnet-topped Doublet, Spinel Triplet, Copal Resin, Bakelite and Imitation Coral.

Prerequisites: Basic Gemmology or Equivalent

Gem Identification #2



Dates: May 20th to 23rd, 2019

Venue: Naarden, Holland

Please Note: To accommodate overseas students and meet the 30 hour requirement, this workshop will be held over four days (7 1/2 hours per day).

Course Cost € 500

[Reserve Your Place Now](#)

This five day (30 hour) practical workshop focuses on the study and identification of four colour groupings (blue, violet/purple, brown and black) plus unusual and phenomenal gemstones. Gemstones covered in this workshop include:

Sapphire, Benitoite, Spinel, Tanzanite, Apatite, Tourmaline, Topaz, Aquamarine, Quartz, Iolite, Zircon, Scapolite, Garnet (Grape, Rhodolite and Hessonite), Chrysoberyl, Taaffeite, Idocrase, Ekanite, Sinhalite, Korerupine, Andalusite, Kyanite, Euclase, Smithsonite, Sugilite, Charoite, Lapis Lazuli, Sodalite, Turquoise, Odontolite, Serpentine, Chrysocolla, Petrified Wood, Hematite, Marcasite, Pyrite, Jadeite, Jet, Chalcedony, Jasper, Coral, Obsidian, Cubic Zirconia, Bakelite, Dyed Jasper, Lab-created Forsterite, Lab-created Spinel, Lab-created Quartz, Glass, Gilson Lapis Lazuli, Gilson Turquoise, Stained Howlite, Star Sapphire, Star Ruby, Star Almandite Garnet, Star Diopside, Cat's Eye Chrysoberyl, Cat's Eye Tourmaline, Cat's-Eye Quartz, Hawk's Eye Quartz, Tiger's-Eye Quartz, Bi-Colour Tanzanite, Bi-Colour Tourmaline, Ametrine Quartz, Watermelon Tourmaline, Usambara Tourmaline, Trapiche Emerald, Labradorite, Moonstone, Bloodstone, Tortoiseshell, Shell Cameo, Hardstone Cameo, Lava Cameo, Ammolite, Fire Agate, Black Opal, Crystal Opal, Semi-Crystal Opal, Larimar, Malachite, Lab-created Cat's Eye Chrysoberyl and Imitation Cameo.

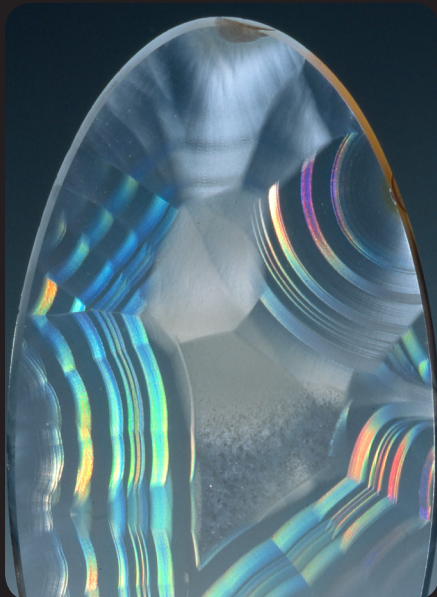
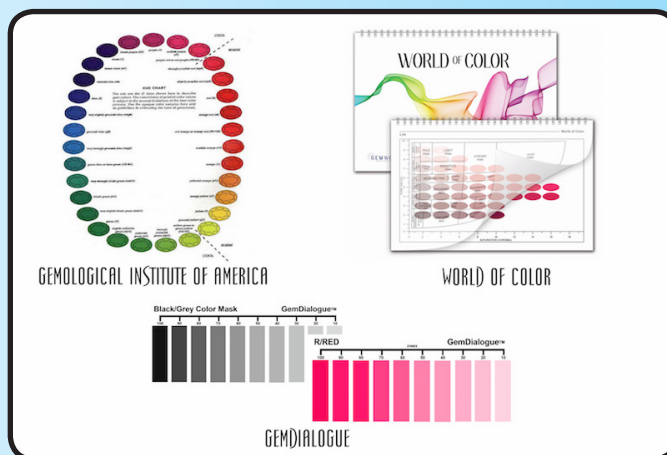
Prerequisites: Gem Identification #1 or Equivalent

Practical Workshops

Coloured Gemstone Grading #1

This five-day (30 hours) workshop includes practical instruction on how to access the hue, tone and saturation of coloured gemstones using three popular colour grading systems (Gemological Institute of America, GemDialogue and World of Color) and how to grade pearls, jadeite and opals.

Prerequisites: None



Dates & Venues: TBA

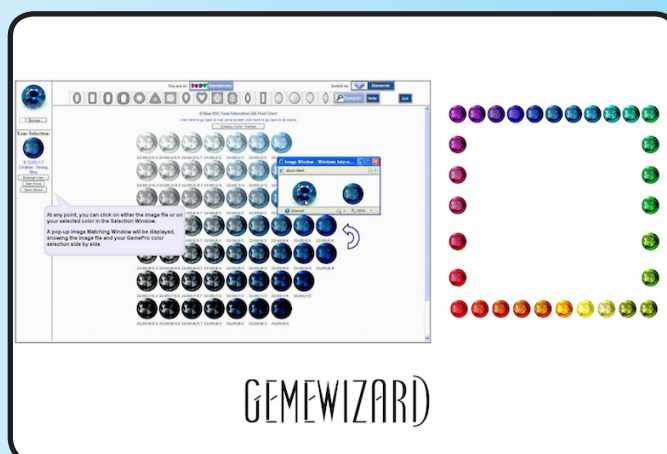
Course Cost € 500

[Reserve Your Place Now](#)

Coloured Gemstone Grading #2

This 100 hour online course consists of a comprehensive overview of the GemWizard Colour Grading System including colour theory (hue, tone and saturation), how they impact on the value of gemstones, practical exercises that are completed online, and a six month subscription to the Gemewizard program.

Prerequisites: None



Online Course

Course Cost € 1000

[Reserve Your Place Now](#)

Practical Workshops



Dates & Venues: TBA

Course Cost € 500

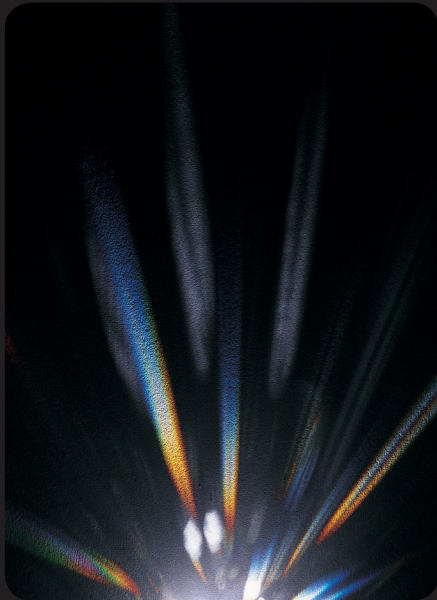
[Reserve Your Place Now](#)

Lab-created & Treated Gems

This five day (30 hour) practical workshop focuses on lab-created gemstones (specifically rubies, sapphires and emeralds) and the many treatments and enhancements that are used to improve the appearance and/or value of gemstones, including:

- Heat treatment
- Surface and Sub-surface Diffusion
- Irradiation
- Fracture Filling
- HPHT Treatment
- Oiling
- Waxes & Dyes
- Sugar/Acid & Smoke Inhalation
- Quench-crackling with Dyes
- Coating & Foil Backs
- Laser Drilling

Prerequisites: Advanced Gemmology or Equivalent



Dates: November 11th to 18th, 2019

Venue: Madrid, Spain

Course Cost € 1750

[Reserve Your Place Now](#)

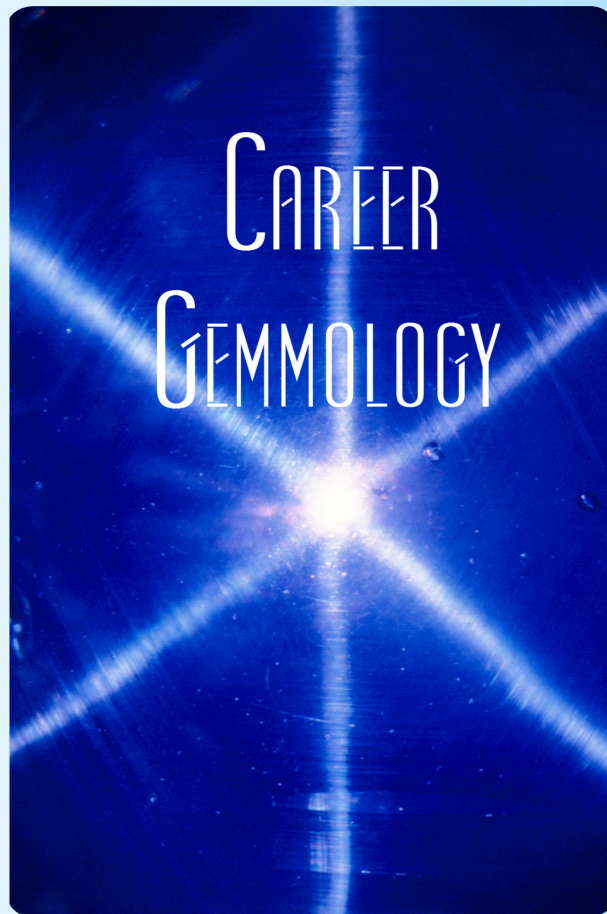
Diamond Grading & Lab-created Diamonds

This eight day (48 hour) practical workshop focuses on the clarity and colour grading of diamonds, how to measure the proportions and how to distinguish natural from HPHT and CVD diamonds.

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- Colour Grading
- Calculating Table Percentage
- Calculating Crown Angle
- Calculating Pavilion Percentage
- Estimating Girdle Thickness
- Assessing Symmetry & Polish
- Lab-Created Diamonds
- Practical Review

Prerequisites: Diamonds or Equivalent



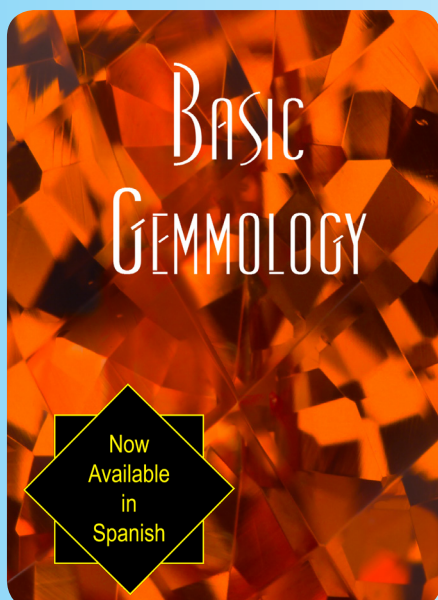
Course Content

The chemical nature of gemstones, their physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction, reflection and the refractometer, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification, thermal conductivity, imitation, assembled and lab-created gemstones, the methods used to manufacture lab-created gemstones including Verneuil, Czochralski, flux melt, hydrothermal, skull crucible, zone melt, horizontally oriented crystallization, high pressure, high temperature (HPHT), chemical vapour deposition (CVD), detonation, ultrasonic cavitation, sublimation method, and modified Stober method, their unique identifying features, treatments and enhancements including heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, high pressure, high temperature (HPHT), quench-crackling, surface modifications, coatings and foil backs, laser drilling, and irradiation, gem mining and cutting, diamond and coloured gemstone grading, gem identification by colour and transparency, advanced gem testing techniques and a comprehensive overview of the twenty-seven most common groups, species and varieties including diamonds, corundum (rubies and sapphires), beryl (emeralds, aquamarines and other precious beryls), chrysoberyl (alexandrite and other chrysoberyl), spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, opal, jadeite, kunzite and hiddenite, feldspars, iolite, andalusite, diopside, apatite, pearls, coral, jet, ivory and amber.

Course Cost: € 1400

Prerequisites: None

Please Note: This course includes all the information contained in the Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones courses.



Course Content

The chemical nature of gemstones, physical and optical properties, basic crystallography, the absorption of light, the spectroscope, refraction and reflection, the refractometer, optical character and sign, dispersion, reflectivity meters, polarized light, the polariscope, pleochroism, the dichroscope, colour filters, specific gravity, luminescence, magnification and thermal conductivity.

Course Cost: € 200

Prerequisites: None

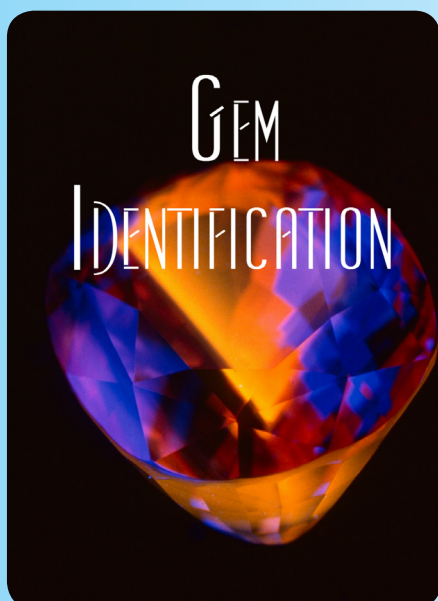


Course Content

Imitation and composite gemstones, methods used to manufacture lab-created gemstones including Verneuil, Czochralski, Flux Melt, Hydrothermal, Skull Crucible, Zone Melt, Horizontally Oriented Crystallization, HPHT, CVD, Detonation, Ultrasonic Cavitation, Sublimation Method, and Modified Stober Method, their unique identifying features, treatments and enhancements including heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, glass fracture filling, cobalt doped glass filled sapphires, clarity enhanced diamonds, HPHT, quench-crackling, surface modifications, coatings and foil backs, laser drilling, irradiation, and advanced gem testing techniques.

Course Cost: € 400

Prerequisites: Basic Gemmology or Equivalent

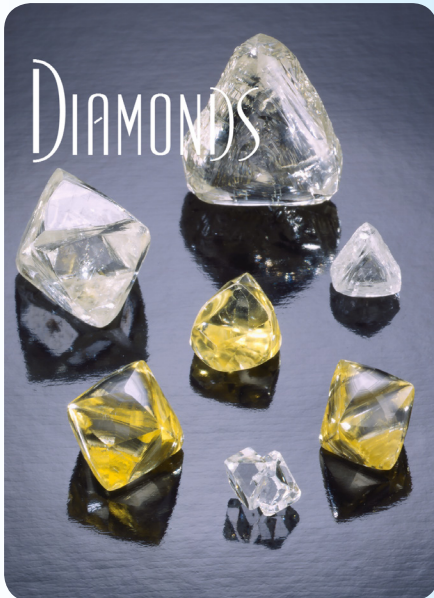


Course Content

Introduction to gem identification and the tests that are commonly used to identify gemstones. An in-depth look at each of the ten colour groupings (colourless or white, red, pink, orange, yellow, blue, green, violet or purple, brown, black or grey) plus phenomenal or unusual gemstones. Important varieties and species of gemstones that commonly occur within each colour grouping. How to distinguish gemstones that are commonly confused with each other (i.e. aquamarine and blue topaz, emerald and chrome tourmaline, diamond and lab-created moissanite) or have physical and optical properties that are similar (i.e. amethyst quartz and purple scapolite). All lab-created, imitation, treated and enhanced gemstones that are found in each colour grouping.

Course Cost: € 225

Prerequisites: Basic & Advanced Gemmology or Equivalent

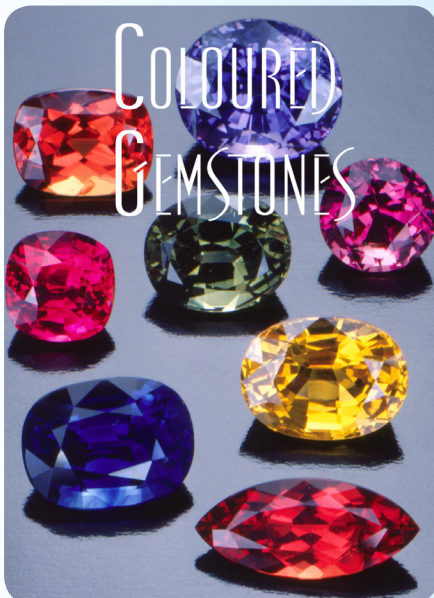


Course Content

Physical properties, geology, localities, principle mines, crystal system, chemical composition and classification, fancy colours, causes of colour, absorption spectra, pleochroism, inclusions, fluorescence, mining, gem identification, methods of synthesis, common treatments and enhancements. You will learn all about the 4 C's (colour, clarity, cut and carat weight) and how they are measured and assessed. We will also compare the various 'Cut' criteria for the Gemological Institute of America (GIA), the American Gem Society (AGS), Hoge Raad Diamant (HRD), International Gemological Institute (IGI), the European Gemological Laboratory (EGL), and Accredited Gem Appraisers (AGA) and explain how the estimated weight of a 'mounted' gemstone is calculated.

Course Cost: € 225

Prerequisites: None

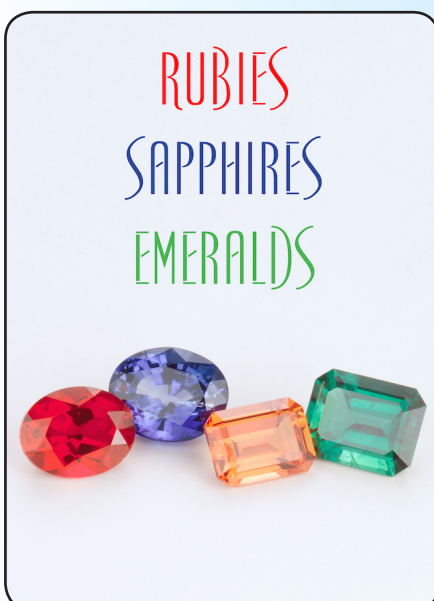


Course Content

Physical properties, geology, localities, crystal system, chemical composition and causes of colour, varieties, absorption spectra, pleochroism, inclusions, fluorescence, gem identification, synthesis, treatments and enhancements, and care guidelines. Gemstones covered in this course include rubies and sapphires, emeralds, aquamarines and other precious beryls, alexandrite and other chrysoberyls, spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, kunzite, hiddenite, feldspars, iolite, andalusite, diopside, apatite, pearls, coral, jet, ivory, and amber. You will learn how to accurately describe colour, the various colour grading systems currently used by professionals, the clarity classification of gemstones based on their geological environments, how cut is assessed, and how to grade opals, jadeite and pearls.

Course Cost: € 500

Prerequisites: None



Course Content

Topics covered include a complete overview of their physical and optical properties, principal sources, mining, how they can be identified from gemstones that can be deceptively similar in appearance and their lab-created counterparts, common treatments and enhancements, pricing guidelines, what constitutes the best quality and how to properly care for them.

Course Cost: € 95

Prerequisites: None



Course Content

Topics covered in the course include their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, cause of colour, absorption spectra, common inclusions, fluorescence, mining, grading criteria, methods of synthesis, gem identification, common treatments and enhancements, cleaning and care instructions, and pricing.

Course Cost: € 75

Prerequisites: None



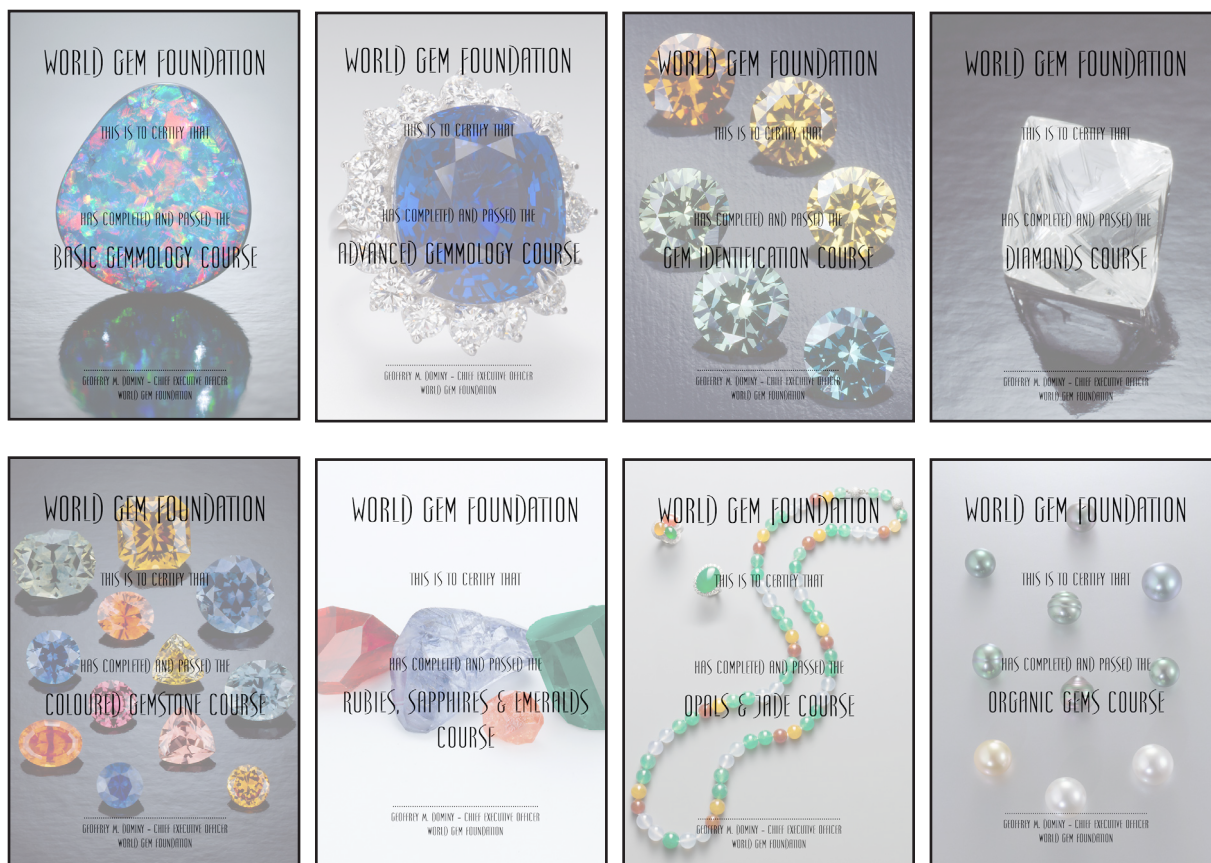
Course Content

Topics covered include their physical and optical properties, geological formation, crystal systems, chemical composition, varieties and classification, cause of colour, common inclusions and internal characteristics, fluorescence, pearl grading criteria, methods of synthesis, gem identification, common treatments and enhancements, and cleaning and care instructions.

Course Cost: € 50

Prerequisites: None

Theory Courses - Letters of Completion



Practical Workshop - Letters of Completion





Objective Diamond Clarity Grading

Michael D. Cowing

Edited by Geoffrey M. Dominy
Author of The Handbook of Gemmology

What People are Saying:

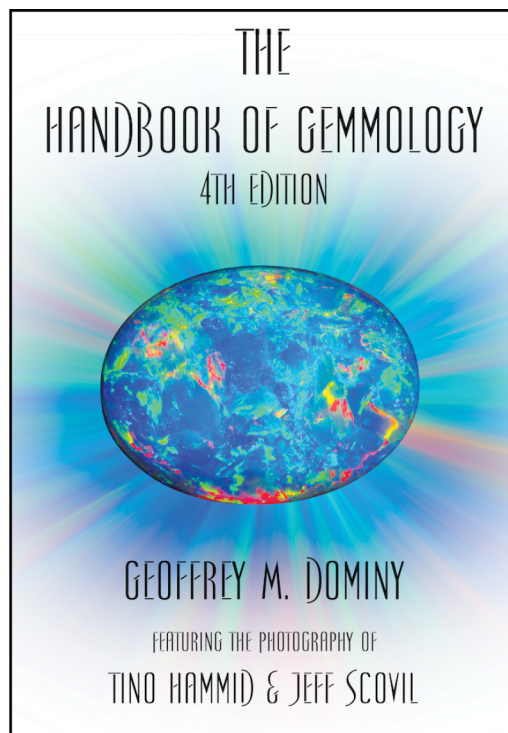
'Leave it to Michael to grab on to the math of the 'Golden Spiral' and doggedly work it until he could present a mathematical method for consistent clarity grading'. Gary Roskin - Executive Director of ICA

'Any diamond professional or anyone interested in diamonds and diamond grading will be enriched by reading this' Peter Yantzer - Former Executive Director of AGS

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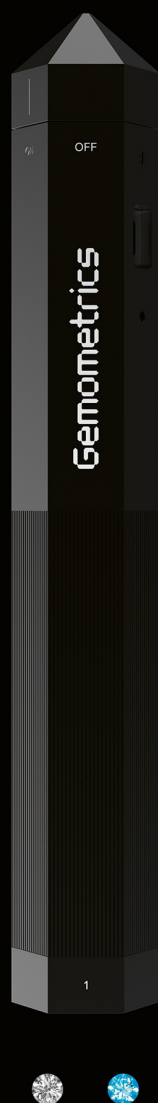
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Geoffrey M. Dominy
WGF Founder

Geoffrey Dominy is an author, independent gemmologist and former jewellery appraiser who appeared on the Canadian Antiques Roadshow for four seasons. He received his F.G.A through the Gemmological Association of Great Britain (Gem-A) in 1987 passing the diploma examinations with distinction.

Throughout the 1990's, Geoff developed and taught the 'Gemmology' program at Red River Community College and The University of Manitoba in Winnipeg, Canada, worked for the Canadian Institute of Gemmology, was President and Founder of the Jewellery Appraisers Association of Canada and was a contributing author for the 5th & 6th Editions of Robert Webster's 'Gems' which even today is considered one of the most authoritative textbooks in Gemmology.

In 2013, he released the first digital gemmological textbook entitled 'The Handbook of Gemmology' in collaboration with world famous gem photographer Tino Hammid. Now in its fourth edition, the handbook has been sold or downloaded in fifty-three countries, is used by fourteen schools, colleges, universities and gemmological organizations as their recommended textbook and now features photographic contributions by other award winning photographers including Jeff Scovil.

Geoff has just released a 5th Anniversary Printed Edition (Two Volumes) and hopes to publish Gemología Para Todos (the first 14 chapters of the Handbook of Gemmology) in Spanish in 2019.

He currently lives in Palma, Mallorca, Spain and in addition to lecturing and promoting his book, is the founder of the World Gem Foundation and Mi Isla También.



Leone Langeslag
Dutch Gem Academy

Leone Langeslag is a graduate of the Federation for European Education in Gemmology (FEEG) (2006), an independent gemmological consultant and is actively involved with the Gemma Association in Holland offering lectures and workshops. Her desire to provide accessible gemmological training in the Netherlands has lead to the formation of the Dutch Gem Academy.

Leone is a frequent visitor to international symposiums, exhibitions and trade shows where she continues her own gemmological education and passion for collecting gemstones and minerals.



Deborah Mazza
British Gem Academy

Deborah Mazza is half Italian and half British, and started her journey through the world of gemstones in Germany in 1984, where she studied at the Deutsche Gemmologische Gesellschaft attaining her gemmology and diamond diploma; she subsequently gained her FGA in 1986.

Deborah then went to work for the trade in Idar-Oberstein, buying and selling wholesale gems and diamonds, working as a gemmologist and teaching gemmology at the DGemG, this lead on to carrying out jewellery valuations for an insurance company in Germany. She later got a Bachelor in Business in Germany, and returned to the UK in 2010, where she became a tutor for the Gem-A's online courses. Deborah, keen to add to her knowledge, started to study again and passed the NAJ/IRV's CAT jewellery valuation diploma, and is now studying History of Art at Goldsmiths University. Deborah has her own valuation business and works part-time for an online auction house. She contributed several written pieces for Yavorsky's new book, Terra Connoisseur: Gemstones. She is currently the Director of Education for the British Gem Academy.



Conny Forsberg
Scandinavian Gem Academy

Conny Forsberg has over thirty years experience as a gemmologist and precision gem cutter. He received his FGA in 1986 through Gem-A, his diamond grading diploma through Hoge Raad voor Diamant (HRD) in 1994 and is an Accredited Senior Gemologist with the Accredited Gemologist Association (AGA).

He is currently the owner of the Swedish Gem AB, a modern and accomplished gem lab as well as a precision cutting facility. He has twice received 'Honourable' mention in the Gem-A photo competition for his photomicrography (2011 & 2013) and is a valued contributor to the Handbook of Gemmology, with a large collection of his photomicrographies planned for the upcoming 4th Edition. Conny is also an Accredited PRINCE2 Practitioner (Project Management), experienced in public procurement and contracting (EU law) and the initiator and organizer of the Scandinavian Gem Symposium. He is currently the auditor for the Swedish Gemmological Association.

Jan Asplund is a gemmological consultant specializing primarily in the identification and valuation of diamonds, both cut and rough, as well as coloured gemstones and jewellery.

He received his FGA & DGA (Gem Diamond Diploma) through Gem-A in 2011, his BA in History from the Mälardalens University in 2000 and studied geology and gemmology at Luleå Technical University (2005 – 2007), cultural and industrial history at the Uppsala University (1998 – 2000), and archival science at Karlstads University (1998 – 1999). Jan also took his Accredited Jewelry Professional – AJP (Gemological Institute of America 2011), Introduction to Watches (International School of Gemology 2012), Jewellers Education Foundation – Graduate Sales Associate (American Gem Society 2011), Blacksmithing (Sätergläntan 2002) and Silversmithing (Tärna Folkhögskola 1996).

He is a board member of the Swedish Gemmological Association, fellow and diamond member of Gem-A and initiator and organizer of the Scandinavian Gem Symposium.



Jan Asplund
Scandinavian Gem Academy



Leroy Bakelmun
Gem Academy of Canada

Leroy Bakelmun started his gemmological career after receiving his certificate in gem cutting and polishing at the Lapidary Training Centre Sri Lanka in 1995. In the same year he also received his certificate in Gem Identification, through the A.K. Institute of Gemmology in Sri Lanka.

In 2006 he received his 'Gemmologist' certificate through the Canadian Institute of Gemmology (C.I.G.)

Leroy has extensive experience buying and selling gemstones. From 1997 to 2014, he owned and operated GeoGem Jewellers in Langley, British Columbia, Canada and from 2012 to 2014, he also owned the 925 House of Silver in Fort Langley, British Columbia, Canada.

Gérard Raphaël Quintin was born in Paris France where he studied Art and Design and graduated from Ecole Boulle. His taste for the diamond world may have been inherited from an uncle who worked in the diamond business.

In 1978 he took the gemology colored stone and diamond course with GIA while he was mining diamonds in the Sewa River in Sierra Leone and where he started the first diamond cutting center in West Africa.

In Abidjan Côte d'Ivoire in 1992 Gérard founded the diamond cutting formation center with a gemological laboratory 'Hardy's', followed by the installation of the colored stone and diamond cutting facilities in the jewelry school EIBMA.

Continuing his tour in the world of gemstones, Gérard went to Madagascar as an expert for a French Government project to develop the organization and skill of the gems sector.

Professor of Gemology in the Jean Guehenno Jewelry School in Saint-Amand-Montrond France, he then moved to Bolivia to fund and manage the 'Instituto Gemologico Boliviano' where students learn gemology and the art of gem cutting.

Since 1997 Gérard has been a member of the Organisation Internationale des Experts based in Geneva, Switzerland.



Gérard Raphaël Quintin
South American Gem Academy



Cristina Rzepka de Lombas
Central American and
Caribbean Gem Academies

Cristina Rzepka de Lombas is a geologist, gemmologist, appraiser of gemstones and jewellery and an expert in diamond and coloured gemstone grading.

Currently Cristine serves on the Board of Directors of the Instituto Gemológico Español (IGE) in Madrid, Spain where she also teaches their 'Gems of Organic Origin' course.

She is also the Director of Education for the Central American and Caribbean Gem Academies.

Kyalo Kiilu is a fellow of the Gemmological Association of Great Britain (Gem-A) and an Alumnus of Birmingham City University where he obtained his BSc with honours in Gemmology and Jewellery Studies in 2017.

His passion for gemstones can be traced back forty years to his late grandmother's village in rural Kenya and the prospecting trench dug by the first British gemstone explorers in the early part of the 20th Century.



Kyalo Kiilu
Kenyan Gem Academy

While pursuing his pharmaceutical studies, his interest in gemstones never diminished. Unfortunately in 2003 there were no colleges in Kenya offering gemmological courses so he decided to relocate to England and enrolled in Gem-A's Diamond Diploma program in 2004; the start of his gemmological journey.

Kyalo is a licenced gemstone prospector in Kenya and in 2015 made a discovery of a very unique sapphire, resembling another Kenyan sapphire marketed as 'Goldsheen Sapphire' that he will hopefully share with the gemmological community very soon.

He comes to the World Gem Foundation and specifically the Kenyan Gem Academy with a strong desire and ambition to share his knowledge of gemstones with his fellow Kenyans, particularly those involved in the production of gemstones, gemstone lovers and aspiring gemmologists, to provide support and encouragement that was so lacking in the industry when he was growing up in Kenya.



Salomon Lutumba
Gem Academy of DR Congo

Salomon Lutumba is an alumnus of Birmingham City University where he graduated with a Bachelor in Science with honours in Gemmology and Jewellery studies in 2016. He also holds a Diamond Diploma and Gemmology certificate from Gem-A. He is originally from the Democratic Republic of Congo.

In 2002 he relocated to England where, ten years later, he found the opportunity to fulfil his dream of studying gemmology at the Birmingham City University. In 2012, he started his High National Diploma in Gemmology combined with Gem-A's Diamond and Gemmology program which led to a degree program, introduced for the first time in 2015, at the BCU.

Today, by embracing the World Gem Foundation's concept and philosophy of gemmological education, and through the Gem Academy of DR Congo, he would like to share his passion and knowledge of gems with his fellow Congolese; particularly jewellers, aspiring gemmologist and gemstone lovers.

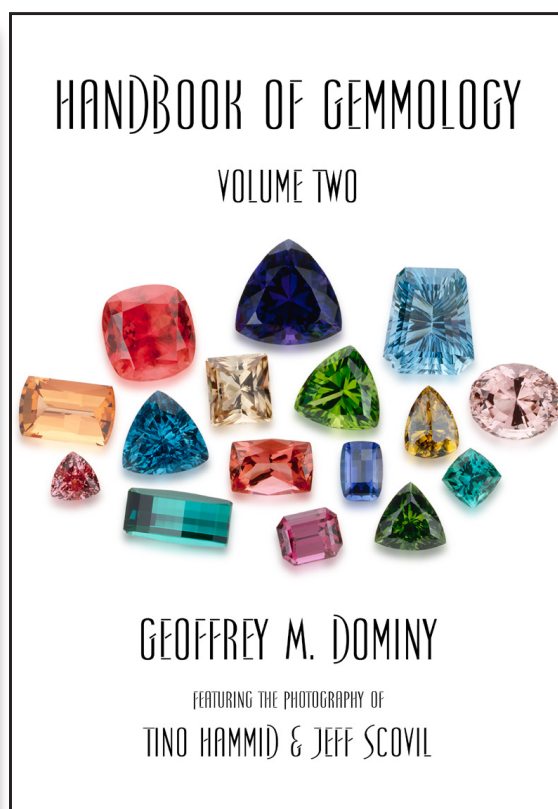
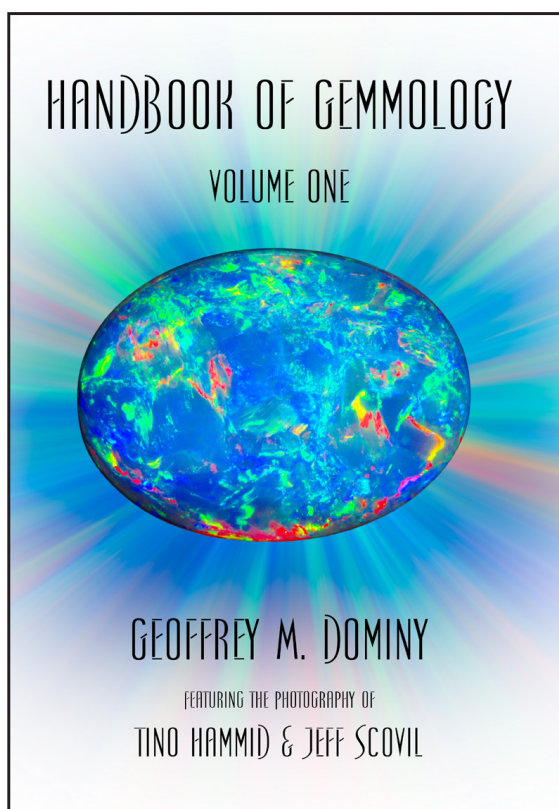
His personal goal is to promote the science of gemmology in his country, by providing information and support to empower people in the jewellery business and those trading in stones.



Jack Ghazalian
American Gem Academy
Director of Corporate & Career
Development

Jack Ghazalian has thirty-eight years of experience in the jewelry industry. He is a graduate gemologist through the Gemological Institute of America (1992), was an instructor for GIA (1993) and was officially Certified-by-the-State of California Education Code 94311(a) to teach Gemology & Jewelry Manufacturing-Arts (1993).

In October 2015, he was honored by the International Distinguished Scholars – Academic Honor Society as an 'International Distinguished Scholar' and in 2017 was granted membership in Kappa Delta Pi. He is currently the owner of Isometric Gemological Appraisal Services in Southern California: IsometricGems.com, speaks five languages and is passionate about education.



What People are Saying:

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LEONE LANGESLAG is the CEO of the Dutch Gem Academy and owner of Sole Leone. She received her European Gemmologist (E.G.) diploma from the Federation for European Education in Gemmology (FEEG) in 2006.



Zircon - Double Vision



Zircons (Photo by Tino Hammid)

Historically, zircon has been used as a gemstone for over 2000 years and is the oldest mineral known to Man with samples found in Western Australia dating back 4.4 billion years. It is of particular interest to geoscientists, due to the presence of trace elements of uranium and thorium, and has spawned a separate discipline known as 'zirconology'.

Often confused with cubic zirconia, colourless zircon was one of the first 'diamond simulants' due to its high refractive index, luster, dispersion and sparkle. However its popularity diminished greatly with the introduction of low cost cubic zirconia in the early 1970's.

History and Geology

The earliest references to zircon can be found in the Bible and it was one of the first twelve gems worn by the high priests of Israel.

The name is derived from the Persian word 'Zargun' (later corrupted to 'jargoon') meaning 'gold-hued' or 'golden colored'.

In 1789, Martin Heinrich Klaproth (1743-1817) a German chemist discovered the element zirconium while studying a sample of zircon from Ceylon (Sri Lanka). Klaproth originally named the new element Zirkonerde (Zirconia or Zircon earth). Later in the early 1800's, Sir Humphry Davy (1778-1829) an English chemist suggested the name Zirconium.

Today zircon is a common constituent of igneous rocks and is usually found in granite pegmatites and metamorphic rocks. In most cases, however, zircons are recovered as water-worn pebbles (secondary alluvial deposits).

Inclusions

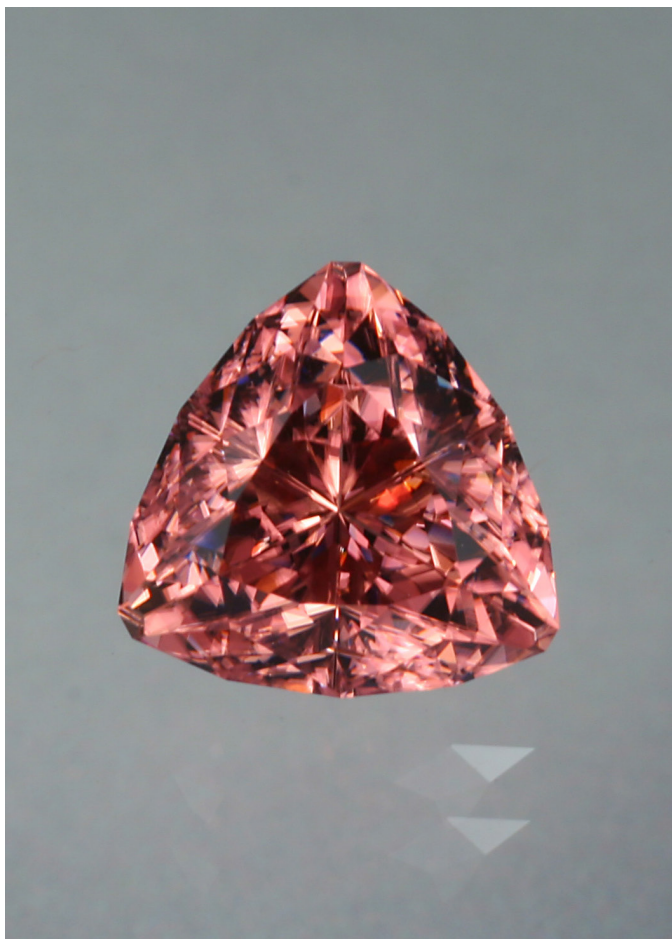
Zircon is typically found without inclusions, although some 'low zircons' can exhibit tension fissures due to metamictisation. Next to these inclusions, parallel stripes, ilmenite (found in fractures) and some healing fissures can also be seen.

Gem Deposits

Zircon is found throughout the world with primary deposits including Myanmar, Sri Lanka, Cambodia, Thailand, Vietnam, Tanzania, Nigeria, Madagascar, Mozambique, Brazil, France, Norway and Australia.

Colours

They occur in a large variety of colours (blue, green, dark red, yellow, brown, colourless and orange) but today it is the 'blue' variety that is the most popular and is sold as an alternative to turquoise for the December birthstone.



Pink Zircon Super Trillion™ 4.99 carats - cut by John Dyer
(Photo by Lydia Dyer)



Honey Zircon Regal Radiant™ 14.42 carats - cut by John Dyer
(Photo by Lydia Dyer)



Sherry Zircon Regal Radiant™ 5.29 carats - cut by John Dyer
(Photo by David Dyer)



Blue Zircon Super Trillion™ 5.43 carats - cut by John Dyer
(Photo by Lydia Dyer)

Physical and Optical Properties

Zircon is a silicate of zirconium (ZrSiO_4) with traces of hafnium, thorium, yttrium and uranium and belongs to the tetragonal crystal system. Due to the presence of these radioactive impurities, which substitute for zirconium in the crystal lattice, there can be wide variances in the physical and optical properties of zircons. The gradual decay of the crystal structure (known as metamictisation) can result in an almost amorphous state in some cases. Zircons are classed as either 'high' (exhibiting the highest refractive indices), 'medium' (mid-range) or in the case of those affected by these radioactive impurities as 'metamict' or 'low' zircons.

Fortunately, due to the combination of a high specific gravity (ranging from 3.93 to 4.73), high refractive index (1.81 to 2.024), strong birefringence or double refraction (.002 to .059) and their brittle nature, zircon is a relatively easy gemstone to identify. The high birefringence explains why some zircons exhibit visible doubling of the back facets giving the stones an almost 'hazy' or 'blurry' appearance.

Zircon can be challenging to cut and requires cutters to pay particular attention to how the finished stone is oriented.

The distinctive absorption spectrum of zircon, consisting of numerous strong narrow bands and fine lines also aids in their identification. The typical uranium spectrum and specifically the line in the red at 653 nm are present in most zircons.

Physical & Optical Properties	Zircon
Crystal System	Tetragonal
Chemical Composition	ZrSiO_4
Colour Range	All Colours
Refractive Index	1.810 – 2.024
Birefringence	.002 to .059
Dispersion	.039
Optic Character	Uniaxial
Optic Sign	Positive
Pleochroism	Yes
Specific Gravity	3.93 – 4.73
Hardness	6 ½ – 7 ½
Cleavage	Poor
Fracture	Conchoidal, Very Brittle
Lustre	Vitreous to Sub-adamantine
Transparency	Transparent to Translucent
Colour Streak	White

Treatments, Synthetics and Care

All colours of zircons are routinely heat-treated, while brown and red zircons are often irradiated. The reddish brown zircons are subjected to heat (900 to 1000 C) in a reducing (oxygen free) environment. This produces different colours including blue and colourless. The results are quite unpredictable and in the case of less attractive colours, by re-heating them in an oxidizing environment, they can turn red, colourless or yellow. This is the result of misplaced electrons returning to their original position in the crystal lattice. Zircons are generally stable when exposed to acids.

Depending on the colour of the stone, there are a variety of different gemstones that can be mistaken for zircon including demantoid garnet, colourless topaz, corundum, tourmaline and sinhalite. While cubic zirconia does have a superficial resemblance to colourless zircon, its isotropic nature (single refraction) and completely different physical and optical properties, make it extremely easy to distinguish.

At the present time, there is no commercial synthesis of zircon, however, zircons have been grown using both the flux melt and hydrothermal methods for scientific research.

While zircon has a hardness of 6.5 to 7.5 on the Mohs Hardness Scale, making it suitable for use in most items of jewelry, its brittle nature does result in surface abrasions and damaged facets. Unless packaged correctly, loose stones transported in stone papers are often described as 'paper worn' due to the stones interacting and rubbing against each other.

Conclusions

Zircon is one of the most under-rated gemstones in the marketplace. With its wide range of colours, incredible brilliance and low costs, it truly does deserve a more prominent place in the world of jewelry. With a 5.00 carat aquamarine (Extra Fine Quality) selling for four times the price of a comparable blue zircon, one can understand why!

References:

Handbook of Gemmology
Gems & Gemmology
Gemdat.org



The World Gem Foundation is delighted to offer five more scholarships this year. These scholarships cover the theoretical components of our Career Gemmology Diploma Program.

Tino Hammid Memorial Gemmological Scholarship



In every industry there are iconic individuals, giants who stand head and shoulders above the rest. In the field of jewellery and gemstone photography, there is little debate that Tino Hammid was a visionary, a rare talent who possessed the unique ability to capture the true beauty of gemstones. For almost forty years his photography adorned the pages of every important publication around the world, showcasing his unrivalled ability to inject realism into his work.

Tino started his career as a staff gem photographer at the Gemological Institute of America (GIA) in Santa Monica, California (1980 to 1982). In 1983 he started his freelance career in gem and jewellery photography and began a 25-year association with David Federman providing photographs for Modern Jeweler's monthly Gem Profile column. During this period they jointly won two Jesse H. Neal awards from the Association of Business Publishers. In 1987 he acquired Christie's Auction house as a client and photographed more than a hundred of their jewellery sales catalogues. In 2012, Tino joined forces with gemmologist Geoffrey M. Dominy and provided the exquisite photographs for The Handbook of Gemmology, the first digitized gemmological textbook released in 2013.

Sadly, Tino passed away in 2015 after a two-year battle with cancer, however through the Handbook of Gemmology and now the World Gem Foundation courses, his legacy and monumental contribution to our industry will live on for future generations to appreciate and admire.

In 2020, the World Gem Foundation will award five scholarships allowing deserving students to take the World Gem Foundation theoretical 'Career Gemmology' course.

The deadline for submitting your application is December 31st, 2019. All applications will be judged by Tino's wife Petra and his oldest daughter Evelyn with the mandate to select those five candidates who, in their opinion, best epitomize the spirit of Tino.

To download the application form, please click on the image below:



World Gem Foundation

Tino Hammid Memorial Scholarship Recipients



Haimanot Sisay
(Ethiopia)



Joel Dyer
(Finland)



Sandra Eriksson
(Sweden)



Lemma Beyene
(Ethiopia)



Muhammad Zeeshane
(Pakistan)

2017



Brandon Williams
(U.S.A)



Asif Rasheed
(Pakistan)



Shakeel Ahmad
(Pakistan)



Khawaja Muhammad Abbas
(Pakistan)



Teklebrhan Teklehaymanot
(Ethiopia)

2018



Muhammad Asif
(Pakistan)



Veronicah Mosweu
(Botswana)



Mohamed Mubassir
(Sri Lanka)



Indra Perkasa
(Indonesia)



Clever Sithole
(Zimbabwe)

2019

Stand out from the crowd

"Education inflames our intellect and makes us grow. It widens our horizons, adds value to our name and instills in our clients, staff, management and industry colleagues, a confidence in our ability that can only be gained from being assessed to the highest of standards by our peers."

Kym Hughes
President NCJV

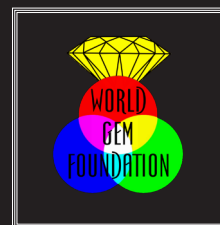
So become enlightened
and
Stand out from the crowd



ncjv.com.au | edu@ncjv.com.au



Academy Directory & Contact Information



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Canadian	www.gemacademyofcanada.com	info@gemacademyofcanada.com
Caribbean	www.caribbeangemacademy.com	info@caribbeangemacademy.com
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Kenyan	www.kenyangemacademy.com	information@kenyangemacademy.com
Scandinavian	www.scandinaviangemacademy.com	info@scandinaviangemacademy.com
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World Gem Foundation

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Australian Opal Centre

The Australian Opal Centre (AOC) is a not-for-profit facility dedicated to opal-related scientific research, education, training, heritage, arts, travel, cultural and economic development. Based in the classic opal mining locality of Lightning Ridge, Australia, the AOC has developed its public collection and programs since 2004, while working towards construction of an innovative building that will be an international hub for opal-related knowledge and activity.

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