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May 2017
Quarterly Publication

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WORLD GEM FOUNDATION

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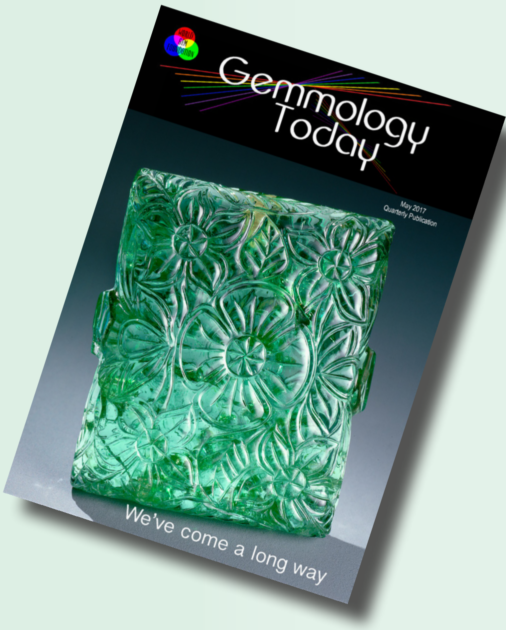

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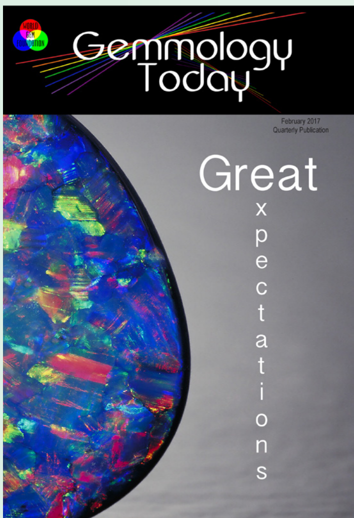

February 2017 Issue

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

World Gem Foundation Founder
Geoffrey M. Dominy

We certainly have come a long way.

The last issue of Gemmology Today reached over 20,000 readers and had an unprecedented number of 'shares' via social media.

Technologically, I wonder what the people responsible for engraving the Mogul Emerald on the front cover would have made of the world today? It is both exhilarating and frightening to think what lies on the not too distant horizon.

Before I purchased my first Mac, I used to complain to my friends that I was going to trade in my Windows PC for a stone tablet and a chisel. Such was my frustration with Windows. When 'tablets' came out, they all joked that now all I needed was a chisel.

Our dependency on technology has had a profound effect on all of our lives; both positive and negative. Gemmology Today has been viewed in over 50 countries because of the technology that is available to us but at the same token, the frustration I feel listening to the 'Neanderthals' talking loudly on their mobiles on a bus, in a bar or at a restaurant or even worse a 'Skype' or FaceTime' conversation in a public place makes me yearn for the 'Good Old Days' when life was simpler, people more polite and the world less complicated.

When I turn on the television or pick up the newspaper, I am reminded how little we have actually progressed. The savagery that exists in the world today is truly frightening, magnified by modern technology that brings it into our homes and into our lives. The senseless killing of people, the use of chemical weapons and the 'mother of all bombs', the possibility of nuclear warfare and the incessant posturing and provocation by world leaders shows us all that we have learned little from history. The people responsible for all this misery are no different from all the other historical figures who have made it their mission to destroy the world.

To be talking about beautiful gemstones, stones produced by the wonders of nature seems absurd sometimes but then again, for me, they have always provided a sanctuary, an escape route, a place where beauty abounds. That is not to say that everything is perfect in the gem world. All we have to do is look at the environmental and social problems connected with mining to see that these beautiful gems are also tainted to a certain extent.

So for the time being, let us divorce ourselves from the problems of the world and indulge ourselves in gemmology. It won't change the world but it may at least make it a little more tolerable.

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).

Shaping an Industry - The Genesis of Diamond Cutting

Modern diamond cutting traces its roots back to the first half of the 14th century when diamonds started to be manufactured in a way we still recognize today. It was probably in Venice around the 1330s that diamonds started to be cut in Europe. By then diamonds had been known for quite a long time without anyone mastering the art of actually cutting them.

When and where were diamonds first used as tools for cutting and polishing other materials (eventually including other diamonds) and how did the development and understanding of diamond properties help?

Pliny tells us in Historia Naturalis that a diamond can be crushed (cleaved?) if it is first put in goat's blood and then beaten with a hammer (Pliny 2016). Splinters of diamond were at the time used in carving tools so there was a demand for splinters of diamond and therefore a technique to break them (Harlow 1998). A suggestion to the interpretation of using goat's blood to cleave diamonds is that it actually is referring to steel being hardened in blood, a liquid better than water for the purpose and only after being hardened could blood steel cleave diamonds (Klein 2005).

A few decades earlier Manilius tells us in Astronomica: 'sic adamas, punctum lapidis, pretiosor auro est;' that a small point of a diamond is more precious than gold, something that Pliny restates.

Why were diamonds considered so valuable? There are a few preserved roman rings with diamonds from the 2nd and 3rd centuries but it was probably not only because of their beauty that diamonds were considered valuable but also because of their apparent indestructibility that gave rise to various myths that diamonds had powers that were transferable to its owner or wearer. We do not know if Manilius ever saw a gem quality diamond and instead was thinking of a diamond as a carving tool when writing about them. A few artifacts, one intaglio and one cameo dating to the reign of Augustus shows characteristics of having been carved by the use of diamonds so we know they were used as a carving tool in Rome during the early years of the first century (Harlow 1998).

So when did humans first make use of diamonds? Surfaces of axe heads in China made of corundum-rich rock, dated around 2500 BCE, show indications of being polished with diamond. So do nephrite axes, dated one thousand years earlier. (lu et al 2005) We do not know if there was an awareness of diamonds when these tools were made and neither do we know where the diamonds came from. Younger artifacts showing traces of being worked by diamonds are in the form of drill holes in beads. Twinned diamond crystals leave a diagnostic pattern so even though there are no tools preserved from this time we still know they existed and with them the knowledge and skill to use diamonds for drilling. The aforementioned beads were found in Yemen and have been dated to around 400 BCE, similar in time to the first recorded historical documents describing diamonds in India. As Yemen was a trade center for diamonds it is somewhat logical that skills in how to use diamonds developed there (Gwinnett and Gorelick 1991).

The well spread use of sand for cutting and polishing rocks suggests that people throughout the ancient world were actively looking for the best sand for various purposes. There are no significant finds of concentrations of tiny diamonds in sedimentary layers but a theory suggests tiny diamonds might form during certain conditions in space and could have been brought to earth by comets, which would explain concentrations of larger amounts of diamonds in sizes suitable for polishing. The size of the diamonds range from 2nm to 300nm, similar in size to those used today for diamond and gemstone polishing.

Diamonds formed by meteorite impacts are known from many locations and are usually fractions of a millimeter in size, convenient for shaping other rocks.

Theoretically ancient Egyptians could have had access to diamonds as tools, which would explain their cutting, drilling and polishing skills. There are no archeological findings supporting this but nanodiamonds created by meteor impacts have been found in the Sahara desert. It is believed that meteorite impacts in carbon rich environments were believed to have created these and other nanodiamonds (Kennett et al 2009, Kramers et al 2013).

The cutting of diamonds for jewelry purposes in Europe emerged in the 14th century and developed further in Belgium during the 15th century. Was knowledge on how to manufacture diamonds until then limited to cleaving and therefore mainly used in natural shapes for jewellery purposes? One reason sophisticated cutting of diamonds or other hard gems did not develop earlier may have to do with the development of tools with continuous rotation improving precision when cutting hard materials (Ogden 2012).

There is a lack of archeological artifacts containing diamonds for almost a millennia, from the late Antiquity to the early Renaissance Period, a circumstance that has been partially explained by the spreading of Christianity and that any pagan beliefs in diamond's 'supposed powers' were abandoned. There are a few historical records mentioning diamonds during this period and they do tell us something about how diamonds could have been used as tools and for the cutting of other diamonds. The first historical documentation of diamonds being used to cut other gemstones is found in the Ratna Pariska by Buddha Bhatta written sometime between the 4th and the 6th century where the following interesting passus reads: 'Wise men should not use a diamond with visible flaws as a gem; it can be used only for polishing of gems, and it is of little value' (A History of Diamond Cutting).

The formulation '…is of little value' indicates that diamonds were not very rare and that any ideas of supernatural powers of diamonds did not apply to stones of lower quality. The supposed belief in diamond's supernatural powers have been given as an explanation for the lack of development of manufacturing methods for diamonds but that does not seem to be appropriate according to what Al-Biruni writes in the 10th century. Al-Biruni tells us that diamonds cut ruby and are unaffected by any superior or inferior material and he is also referencing: '...these people also say that it (the diamond) is the hardest amongst all precious stones and overcomes all other stones, yet the softest and least compact metal breaks it, that is, the lead which is wax like. ...It (the lead) also pulverizes the diamond... When on grinding and pulverization its (the diamond's) pieces get smaller, the jewelers coat them with something that keeps the flies away." (Al-Biruni) This description strongly indicates that diamond powder was used for cutting and/or polishing other materials.

In Agastimata, an Indian work on lapidary believed to have been written in the late 13th or early 14th century there is a description on how diamonds can be finished by using other diamonds. This is about the same time that diamonds were starting to be cut in Europe (Bruton 1978) but it is not known whether the skill to cut diamonds emerged independently in Europe and India or if there was an exchange of knowledge.

There are big gaps in the early technical history of diamonds where historical and archeological evidence does not occur for several centuries. From an archeological viewpoint diamonds were used about 4500 years ago for polishing hard rocks but it took over 2000 years before diamonds were used for drilling and another 400 years before splinters of diamonds started to be used for carving.

Historical evidence tells us there was knowledge on how to splinter diamonds from around the time of Augustus but the next historical mentioning is in Ratna Pariksa about 500 years later and indicates a separation between gem and industrial quality diamonds. Another 500 years later Al-Biruni tells us that diamond powder was used for polishing. It is interesting that the European diamond manufacturing industry starts about the same time as the first documentation in India on diamonds being used to cut other diamond is written.

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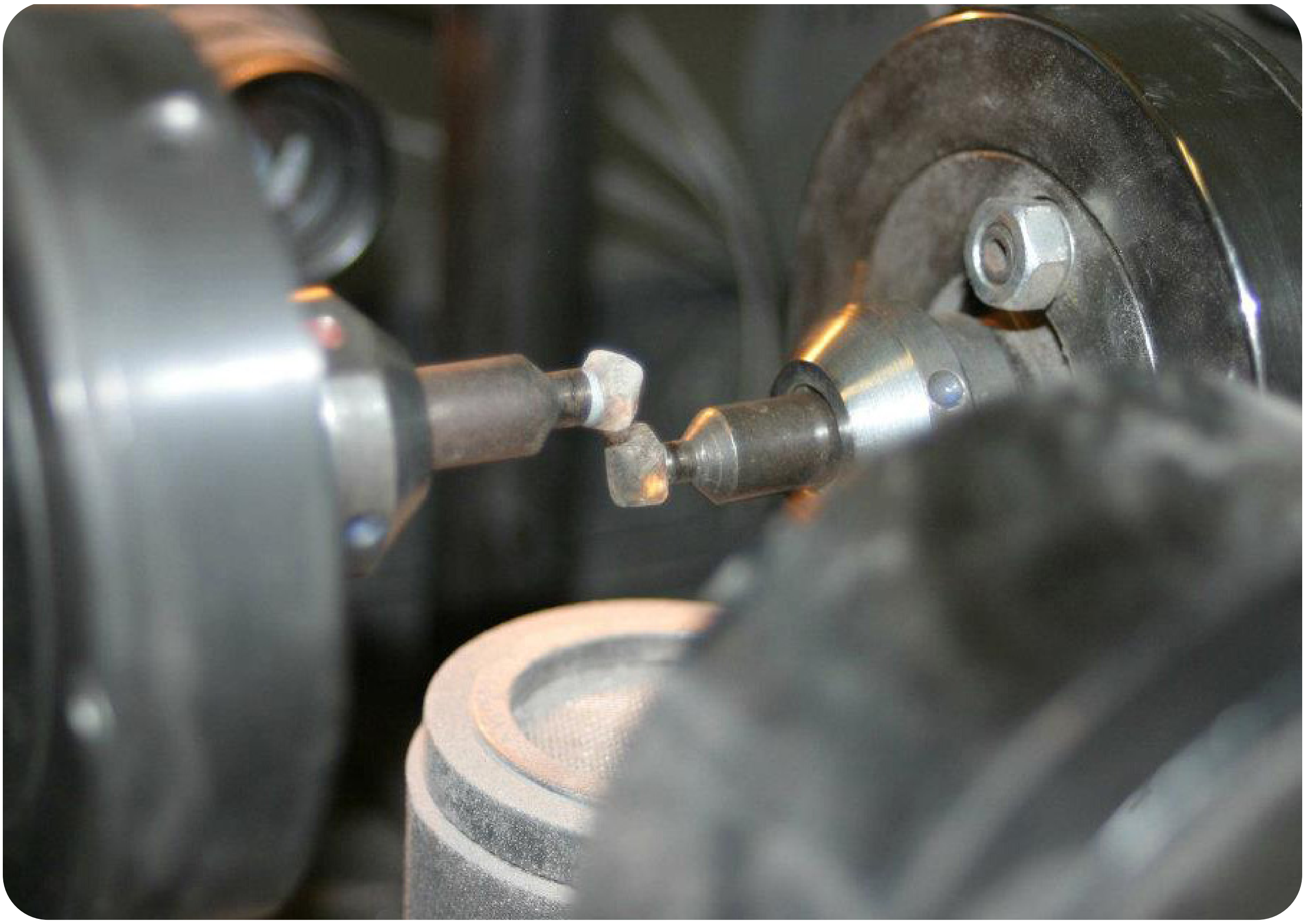
Partially Cut Diamond (Photo courtesy of Embee Diamonds)


Diamond Octahedron with India Ink Marking (Photo courtesy of Embee Diamonds)



Bruting a Diamond (Photo courtesy of Embee Diamonds)

Sawing a Diamond (Photo courtesy of Embee Diamonds)

Diamond Octahedrons (Photo by Tino Hammid)

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HPHT Type 2b Synthetic Diamond with Trigons

A vital feature in the analysis and identification of rough gemstones are the growth markings found on the surface of the crystal. These growth markings not only help us to understand the crystal system and crystal habit but also how the crystal should be cut.

Growth markings are formed on the surface of a rough crystal as a result of natural etching, dissolution or corrosion during the growth or after the formation of the crystal. Irregularities in the crystalline structure of a crystal also assist in the formation of these growth markings.

Characteristic growth markings that are associated with natural diamonds are trigons. Trigons are the equilateral triangular pits/ depressions formed on the octahedral face (111) of natural diamond crystals. These growth markings reveal the molecular structure of the crystal faces, on which they are grown, and hence the crystal geometry.

Trigons are further defined as positive and negative. Negative trigons are oriented with their corners/ points towards the edges of the octahedral face while positive trigons are oriented with their edges parallel to the edges of octahedral faces (i.e. corners/points of the trigon are towards the corners of octahedral face and not the edge of the octahedral face). Points/corners of the positive trigons are coincident with the point/corners of the octahedral face on which they were formed.

Identification of an HPHT synthetic diamond rough is usually an easy call, as its habit and shape (morphology) is characteristic for HPHT synthetic diamonds. IGI-GTL (Delhi) examined one 0.19ct near colorless HPHT synthetic diamond rough, measuring 3.40mm x 2.70mm x 2.57 mm. Its cuboctahedral habit, at first glance, gave the impression that the crystal was an HPHT synthetic diamond. FTIR spectroscopy revealed the rough to be of type 2b with the absorption peak of boron at 2800 cm-1. Morphology of the diamond crystal showed that it was grown on 111 face-oriented substrates.

Microscopic examination however showed some unusual surface markings on the HPHT type 2b synthetic diamond crystal. Octahedral faces of the HPHT type 2b synthetic diamond crystal exhibited an array of triangular depressions; trigons. Metallic inclusions / flux inclusions (remnants of metallic catalyst) were also observed in the HPHT type 2b synthetic diamond rough under the magnification. The metallic inclusions were of irregular shape with some appearing like flowing metal. At times, HPHT synthetic diamonds may also contain triangular metallic inclusions.

Trigons can be formed in two circumstances, by natural dissolution, etching or corrosion or as a result of the partial growth of the diamond layers. Natural diamonds are often subjected to solution after their growth in nature, which leads to etching / dissolution and hence growth markings like trigons are formed. Etching / dissolution also lead to irregular and rounded diamond crystals with unrecognizable faces.

Restriction and absence of a continuous supply of carbon during the growth of the natural diamond can also cause the crystal to develop growth marks and rounded faces. Diamonds grow in layers, with layer-by-layer growth along/ parallel to an octahedral face (111), which also results in the cleavage direction being parallel to octahedral face. Trigons may also form by the irregular supply of carbon, leading to a stoppage of one layer's formation and the initiation of a new layer from some other area with a vacant space between them. Trigons are formed at the intersection points of thousands of layers over the surface of a diamond. Therefore trigons may be the edges of the different layers of diamond leaving triangular pits in between. A combination of both situations may form deep and large trigons.

Synthetic diamonds are free from etched figures and depressions (i.e. trigons etc.) as etching or dissolution or corrosion does not happen during the processes by which the synthetic diamonds are produced. Synthetic diamonds have different types of surface features distinct from those found on the surface of a natural diamond.

Veins Network of Dendritic Appearance

This surface pattern can be found on either a cube or octahedral face of an HPHT synthetic diamond. They are probably the 'imprint' of the dendritic structure of the metal catalyst, which is in a semi-solid state after the completion of growth process.

Parallel Grooves or Striations

Such parallel grooves are found on the surface of HPHT synthetic diamond rough, which are not restricted or confined to any particular crystal face. These grooves could also be the 'imprint' of the metal catalyst surrounding the crystal during its growth.

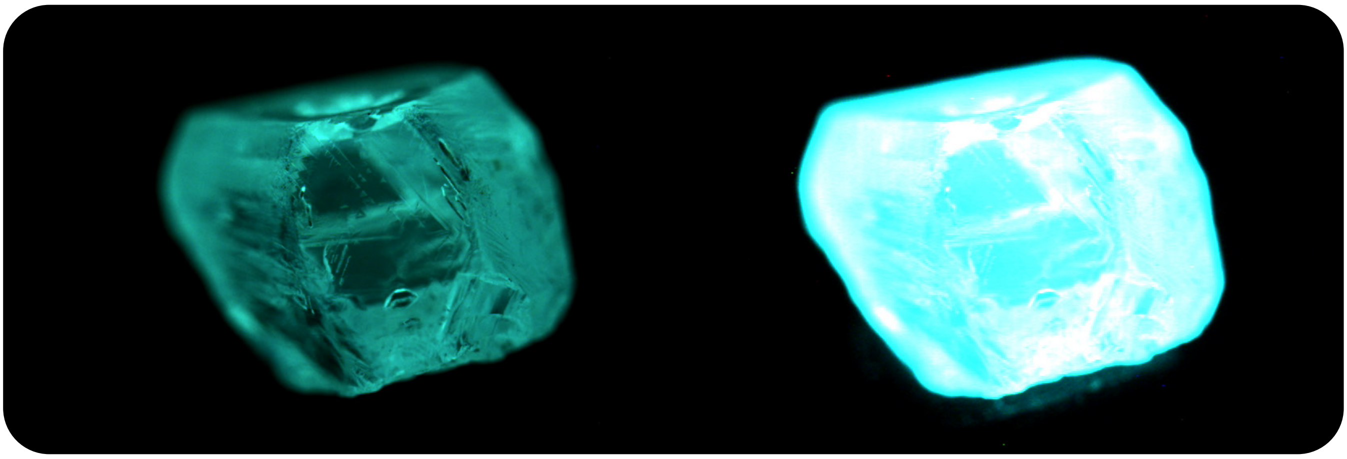
Conclusion

Formation of the trigons on the surface of the HPHT synthetic diamond examined in IGI-GTL (Delhi) could have resulted from any of the trigon formation circumstances / reasons described above. They may have been formed due to etching or dissolution resulting from maintaining the HPHT synthetic diamond at a temperature above the required temperature for growth, after the crystal was formed when the carbon source is finished (at an undesired temperature for diamond to be stable), due to the lack of supply of the carbon or perhaps a deficiency of the catalyst over the diamond leading to irregular growth. It could also be a deliberate attempt to etch the surface of the HPHT synthetic diamond with chemicals.

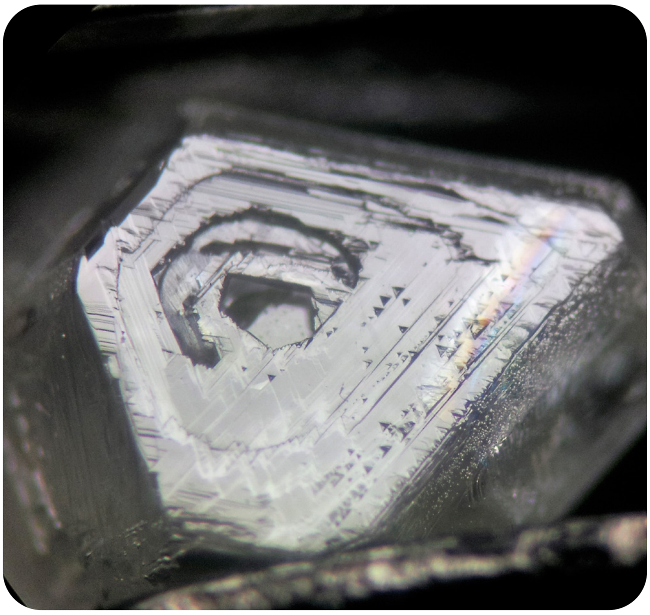
Morphology of the synthetic diamond crystal, presence of metallic inclusions, 'Quick Check *' instrument analysis and Diamond View analysis all concluded that the diamond was an HPHT type 2b synthetic diamond.

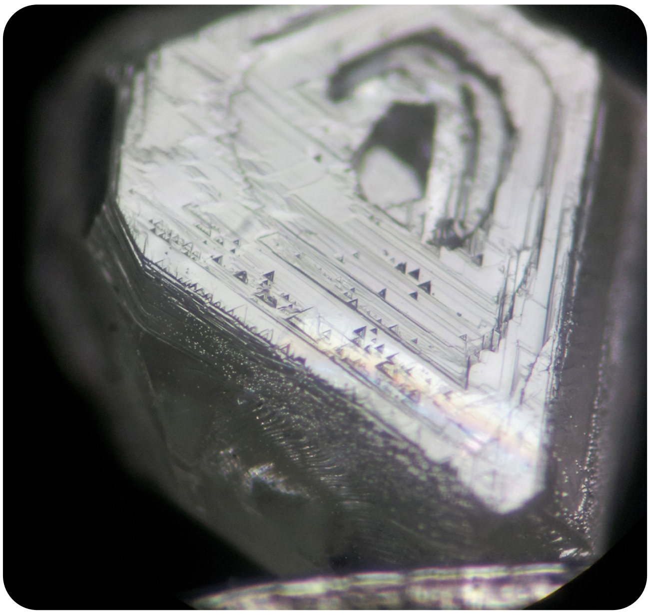
Although trigons have been known as 'signature' characteristics for natural diamond crystals, it is no longer the case. Since they can now also be found on the surface of HPHT synthetic diamonds (and possibly the polished stone), a careful and cautious analysis of all diamonds is required in the future for conclusive identification.

* Quick Check is an instrument launched by the Gemmological Institute of India (GJI) for the identification of Type 2b HPHT synthetic diamonds.

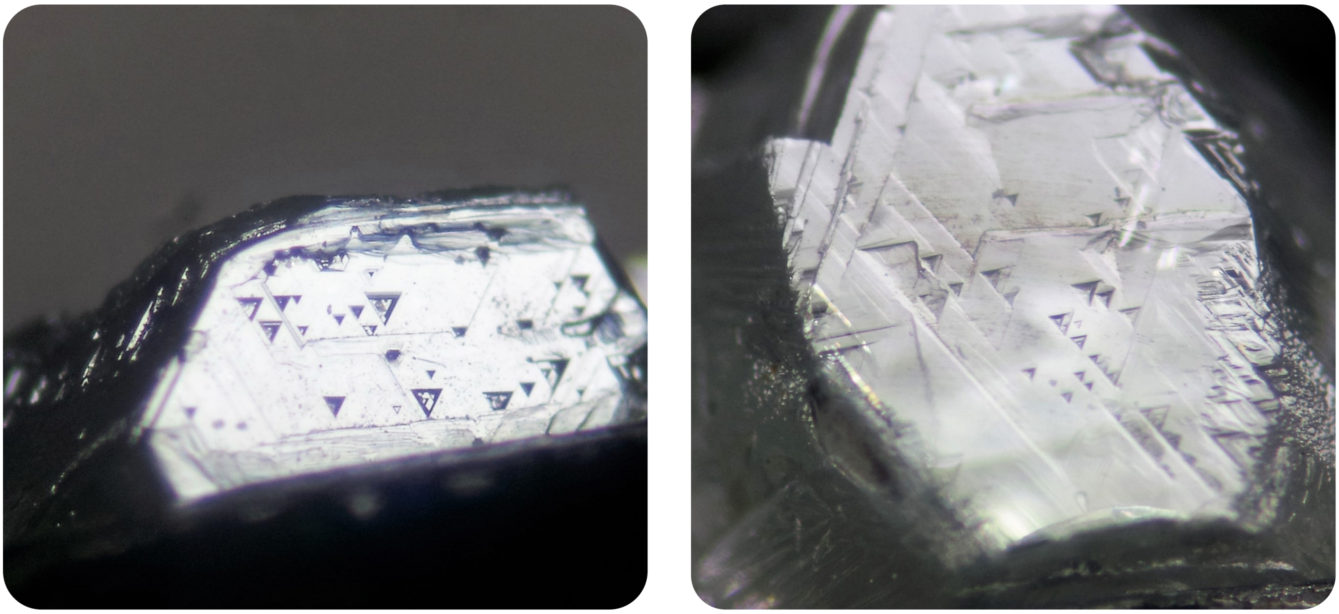


Diamond View Image of HPHT Type 2b Synthetic Diamond. Left Image: Greenish blue fluorescence; Right Image: Very strong greenish blue phosphorescence. Note the trigons visible on the octahedral (111) face and a triangular metal inclusion appearing like a UFO flying saucer.

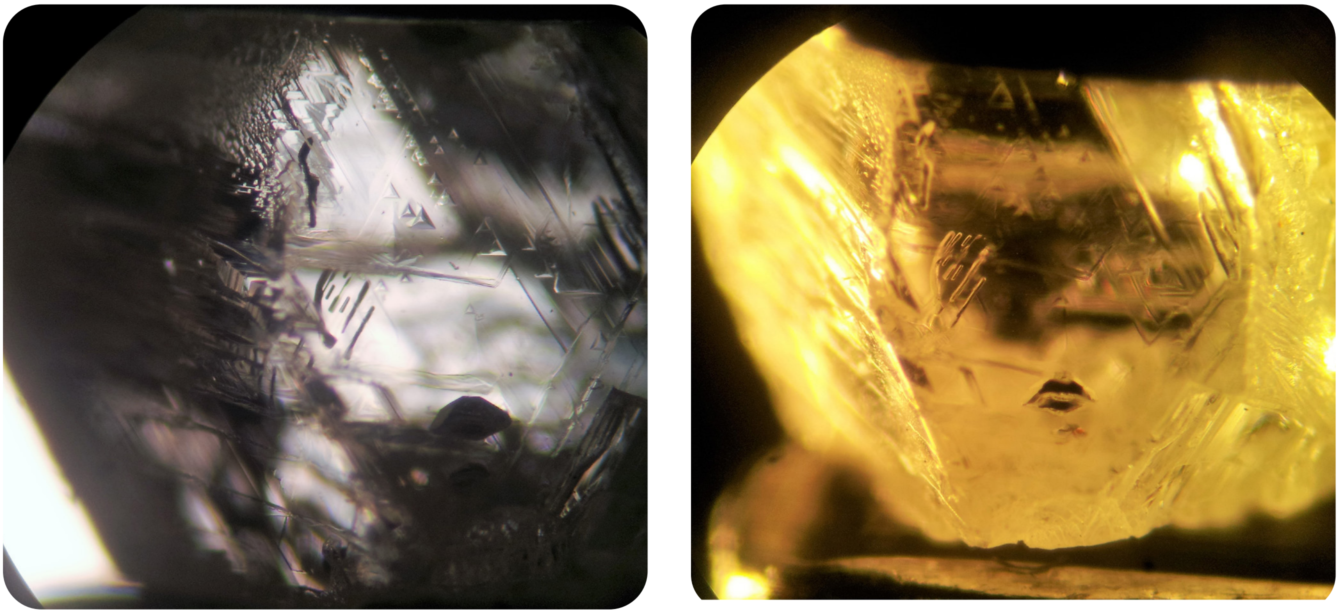




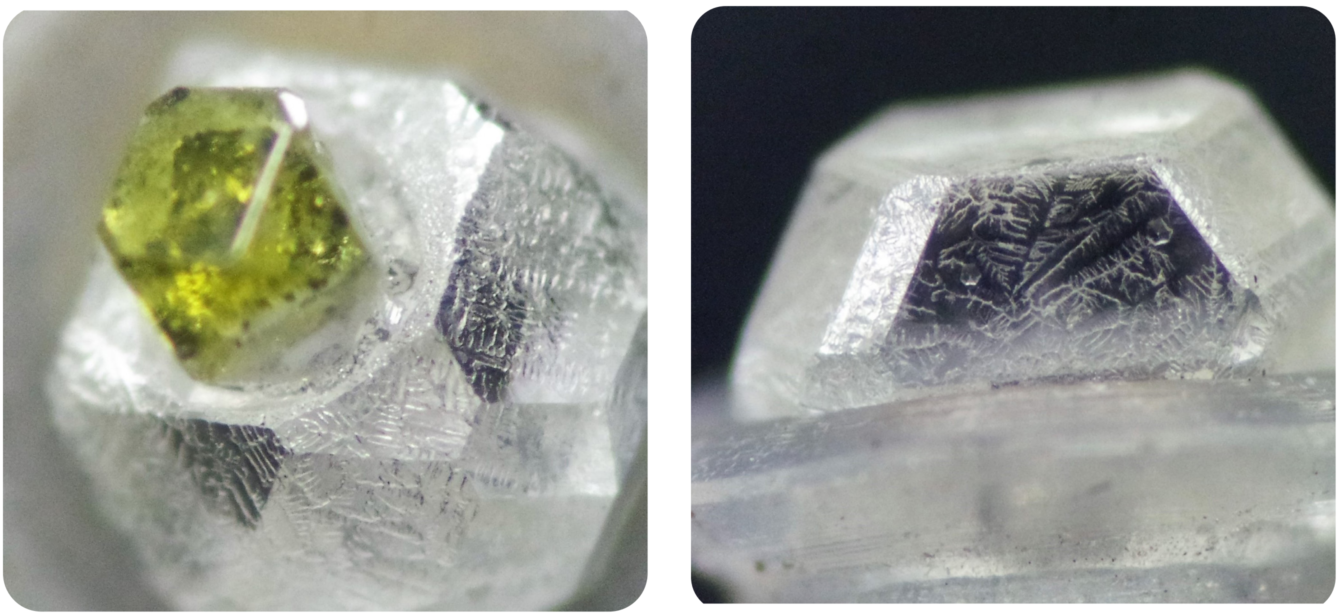
Sample A: Unusually formed trigons on the different octahedral faces of an HPHT Type 2b diamond under magnification in reflected light. The hole in the middle of the crystal face is due to the removal of the seed crystal.



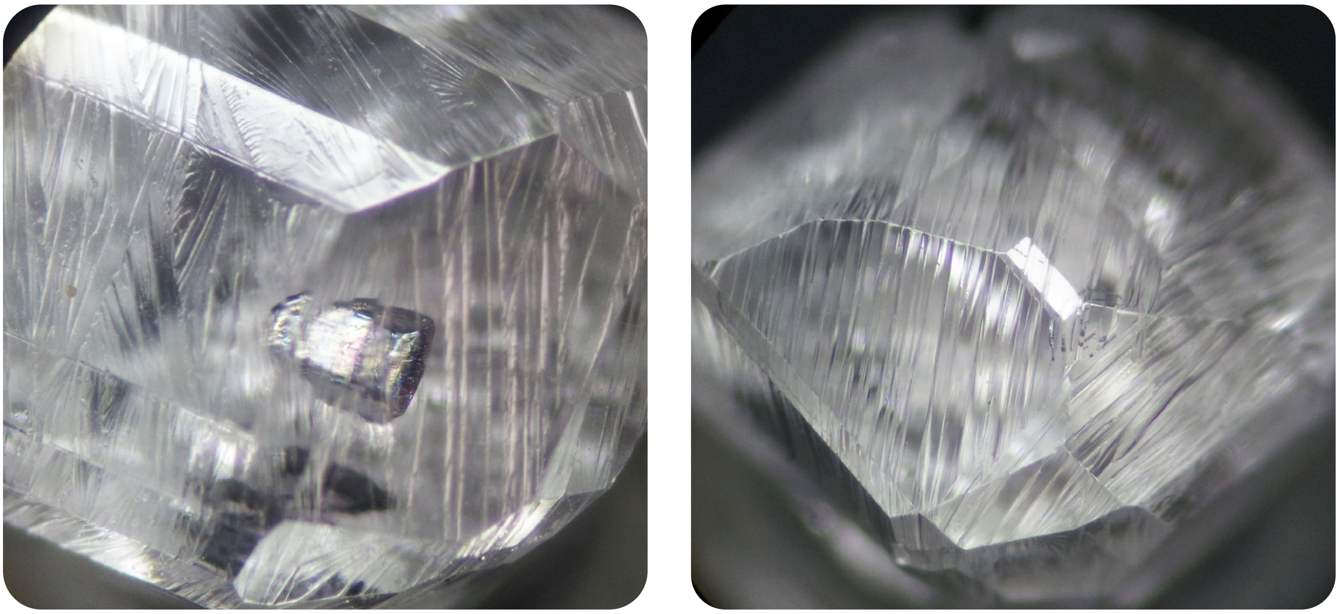
Sample A Unusually formed trigons on different octahedral faces in reflected light.



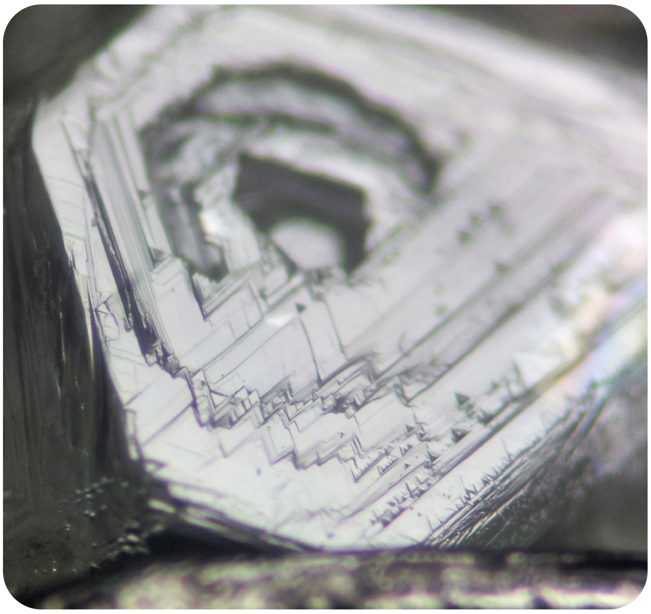
Sample A Left Image: White transmitted light Right Image: Darkfield illumination with yellow light.
Note the trigons on the octahedral face, irregular metal inclusions, appearing as if flowing, and striations.



Sample B Left Image: The yellowish/green seed crystal is still attached to the synthetic diamond.
Right Image: Vein-like network of dendritic appearance.



Sample C Left image: Large metal inclusion showing iridescent colors. Right Image: Parallel grooves or striations.



Sample A Zigzag layer formation of HPHT type 2b synthetic diamond with trigons formed between the layers.

The twelve images in this article represent three samples (Sample A, B & C) of synthetic HPHT rough diamond crystals examined by the Indian Gemological Institute – Gem Testing Laboratory (Delhi).

Photographs and copyright by Meenakshi Chauhan.

Artist or Gem Cutter; Gemstone or Art? To John Dyer they are indistinguishable and why not? We have come along way when it comes to cutting coloured gemstones and John is one of the driving forces.

John Dyer has been cutting gems for over 20 years (since the age of 17). During this time he has won over fifty gem cutting awards including fourteen first prizes. Additionally, John is the only gem cutter who has swept all the awards in one category of the AGTA competition, which he did in 2005, 2007 & 2015.

John's goal is to craft each piece of gem rough into a finished gem that reaches its maximum potential for beauty and market appeal. Working towards this goal he uses a wide variety of cutting styles and techniques each adapted to the individual piece of rough that he is working on at the time. This challenge is the part of gem cutting that he most enjoys and his enthusiasm and care is visible in the gems he cuts.

GT: Artist or Gem Cutter; Gemstone or Art?

JD: The short answer is both! The art is nothing without a quality natural mineral to cut into a gemstone, but the natural mineral is also often unattractive and unappealing without the care of the gem cutter's art. While there are some natural crystals which have their own beauty the majority of gems mined are either worn or broken in such a way that many of the people I show them to outside of the trade say they wouldn't pick them up if they found them lying in the street. Once cut however these same people 'ooh' and 'ahh' over them and often pay substantial amounts of money to own them. That is a big transformation from not being something that seemed worth picking up in the street!

GT: What is the most challenging gemstone you have ever cut?

JD: The next one! Each gem presents its own challenges and once they have been overcome they seem easier. However, often when I am thinking about cutting them and planning what to do the challenge seems larger than once it has been completed.

The tanzanite that I recently cut and won an AGTA Cutting Edge Award with was one of the ones I recall recently being a big challenge. Many of the techniques I use generate a certain amount of heat and tanzanite is a heat sensitive gem so that is nerve-wracking. Just to make matters tenser, this gem started to open up with small cracks in a certain crystal direction. I lost some sleep over that! But thank God I managed to remove the cracks by changing the design a little bit (and losing probably 10-18 carats in the process) and finish the gem without any of the cracks left in it. It is much less stressful to remember the project than it was to actually execute it.

GT: What is the most enjoyable gemstone you have ever cut?

JD: My favorites are beryls (especially aquamarine) when it comes to ease of cutting and getting a beautiful result. They are easy to polish, can be quite clean, good size and have nice sparkle. Sapphires are also good though!

Tanzanite StarBrite™ 120.98 carats (Photo by John Parrish AGTA)

GT: Talk us through the artistic process from the initial concept and design to the finished gemstone.

JD: The concept and design starts with the gem rough. Although I do have a range of designs or styles that I generally do, what dictates which one I choose is primarily the rough I am working with at the time. Each natural gem rough has its own shape, clarity, depth of color, optical properties, size and many other factors which go into helping (or challenging) me to find the best cut to bring out the beauty of that specific crystal.

Sometimes the best choice will be immediately obvious as I look at the rough, many other times though some grinding or sawing will be necessary first and my decision about which cut to do will form as the rough is gradually shaped into a ground preform.

Once the preform is done and faceting starts small adjustments are made to optimize the optics, deal with inclusions that show up and other factors like that.

Citrine Dreamscape™ 8.93 carats (Pair) (Photo by Lydia Dyer)

GT: Art and economics don't always work hand in hand. There is often a fine line between the two. How do you approach it?

JD: By taking a sort of artistic approach to economics! There are many factors to these decisions. Yield is important due to how much gem rough costs, but the highest yield often does not make the most beautiful gem and beauty is what sells. Gems with high dispersion show better with some cutting techniques than others. Some shapes are not popular and sometimes they are just not popular in certain colors. (Try selling a yellow heart shape, it is far harder than a pink, blue or red heart shape!)

Also people who are spending a LOT of money on a super rare type of material tend to be more traditional in their taste when it comes to the cut. But a more traditional cut might not be the most beautiful or best yield for that specific piece of rough. Yet due to the conservative taste of many of the buyers doing what looks best might result in something that takes longer to sell, but might sell for more because it is a larger size. Some styles are more recognizably 'me' than others (I am not known for the emerald cut for example) but some gems just clamor to be an emerald cut.

All of these and other factors go into the decision on what cut to do on a specific piece of rough and are intimately linked to the salability and economics of the business. There are no firm lines drawn on some of these decisions, but I try to make the best decision. This is something I do in my head for the most part (and sometimes confer with my father who is also my business partner) rather than on a computer.

There is a quote from Andy Warhol, which I think applies here:

"Business art is the step that comes after art. I started as a commercial artist, and I want to finish as a business artist. Being good in business is the most fascinating kind of art. During the 'hippie' era people put down the idea of business. They'd say, "money is bad" and "working is bad". But making money is art, and working is art - and good business is the best art."

Interestingly from a value point of view I think gem art is one of the best "values" in the art world. Where else do you have a medium, which costs so much, and the resulting artistic pieces, which are often priced based on the weight rather than simply the impression of the piece? Paintings sell for millions when their materials are hardly worth a hundred dollars, gems that sell for millions however will usually cost millions in the rough too.

GT: What was the defining moment when you decided to cut gemstones?

JD: When we took the rough we had at the time to a cutter and asked him to help us get it cut so we could sell it and he did a really crummy job and overcharged us. This turned out to be a blessing in disguise because it pushed us to buy a faceting machine and we discovered that I love cutting and that has become one of the main cornerstones of our business.

GT: Natural artistic ability or a learned skill?

JD: There is some of both I would say. A certain mechanical and spacial type of intelligence is good, patience is a must, and a TON of practice is also necessary to become really good. I have been cutting for more than 21 years now and from the start I have asked God for ability in this area. He has not only given me my initial "natural" abilities but also helped me to develop my skills and understand and create new techniques and concepts over the years since.

I feel that I am a better gem cutter this year than last year, both in terms of understanding and variety of techniques and small tricks of various kinds to make the work better or faster. In my estimation the quality of the cutting we do has risen fairly steadily over the years. A constant challenge is trying to continually improve techniques and designs to come up with something even more beautiful.

GT: Compared to when you started cutting, is there more awareness and acceptance now for what you are doing?

JD: There is a market shift towards better cutting. There are a number of artistic and high quality cutters out there and each of our efforts at educating the market has an impact on the market as a whole. Because of our collective efforts each one of us has a bigger market today than we would have had years ago. Also what with the internet, social media, videos and other visual means of communication the word is being spread further and faster than ever before. There is still a long way to go before the importance of good cutting is as appreciated as it should be in colored gemstones. But already even the commercial cutters are feeling the pressure to improve and adapt yet they are still WAY behind what the artisan or artistic cutters can do. (And they always will be in my opinion because speed and high quality do not go hand in hand.)

GT: What advice can you give to somebody who wants to start cutting gemstones? Where would they begin?

JD: First they need to be sure they really want to get into this. Are they patient? Willing to work hard for a long time without a lot of income until they get experienced? Up to running their own business and marketing and all that involves? Are they planning on plowing most of what they make back into the business for the foreseeable future? The advice we got when we entered the business has held pretty true so far, "No one gets rich in the gem business, but they sure do get a lot of rocks!"

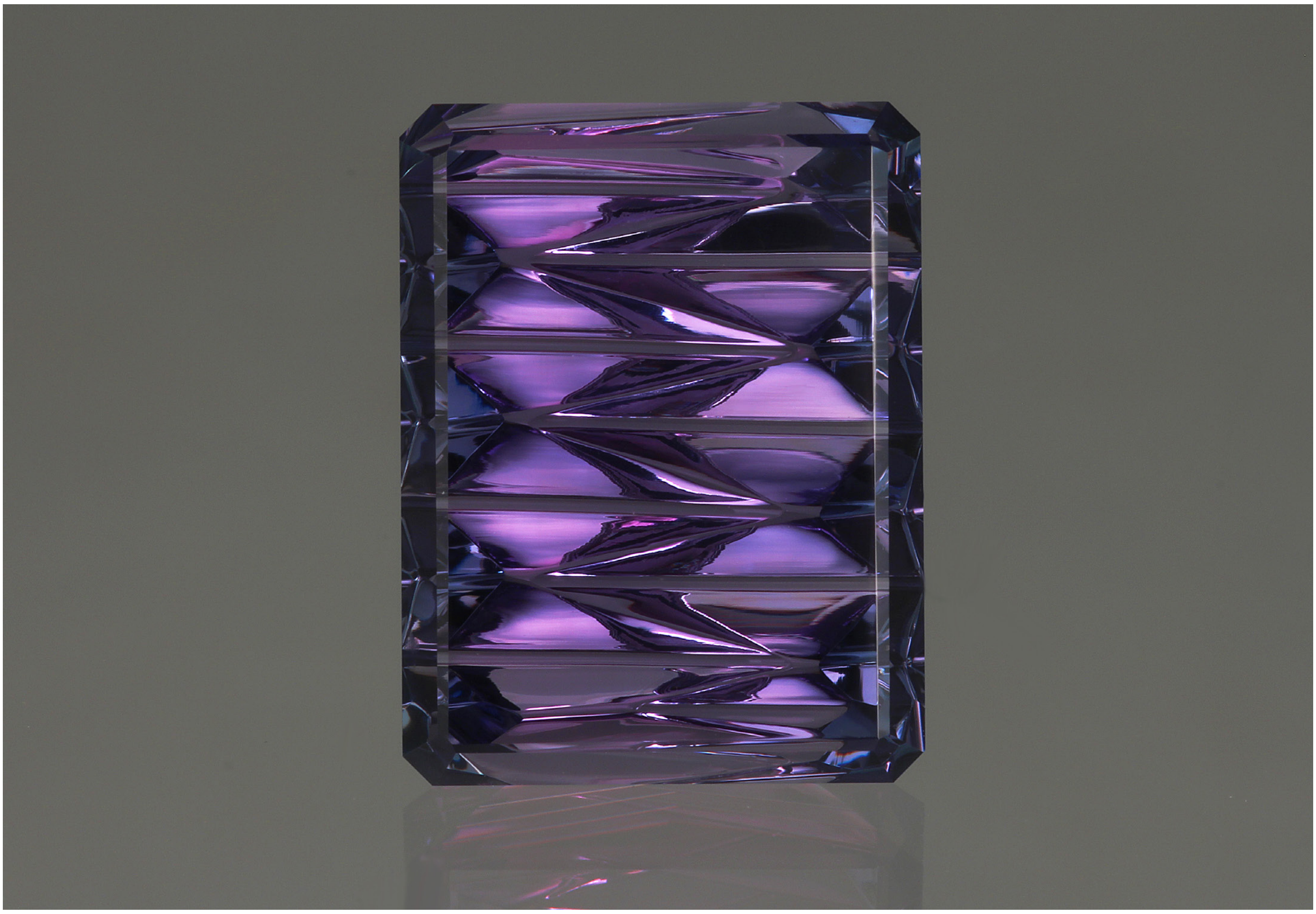
If after taking all this (into account) and the person has some money to start, the best way would probably be to buy a machine (the Ultra Tec is the one I use and sell and I consider it the best) and start at it. If they can take some classes that will also help get them with some of the learning curve. John Bailey teaches classes and although I have never taken any of his classes personally he seems fairly knowledgeable and more geared towards the cutter who plans on being a pro or semi-pro cutter.

For those on a very tight budget it will be a hard business to be in, but still they can try it out by finding a local lapidary club. These kinds of clubs often allow you to use their equipment for a low membership fee and will have retired folks who will teach classes for a price that is very affordable. These kind of hobbyists often have a slightly different outlook on gem cutting from a cutter who is doing things for a living, but they are also usually much more open and interested in spending time with you for no significant financial return.

GT: If we were sitting down one year from now, what would you say constituted a good year for John Dyer?

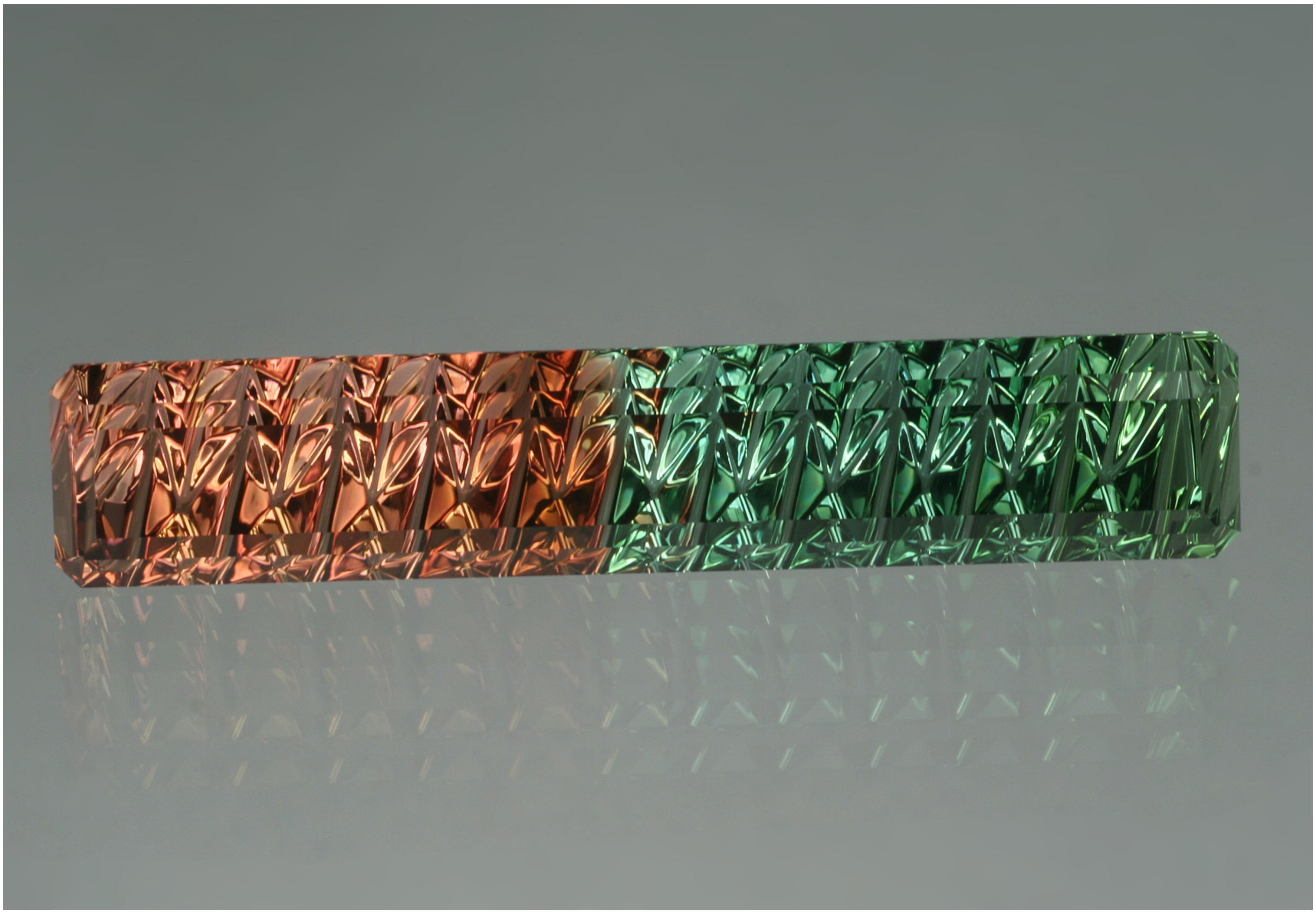
JD: In business terms that would be a better work/life balance, having completed a number of the projects I am working on (both in gem cutting techniques and for running the business better) and having built up the inventory more since everyone always wants the gem you don't have.

Green Tourmaline StarBrite™ 14.56 carats (Photo by Lydia Dyer)

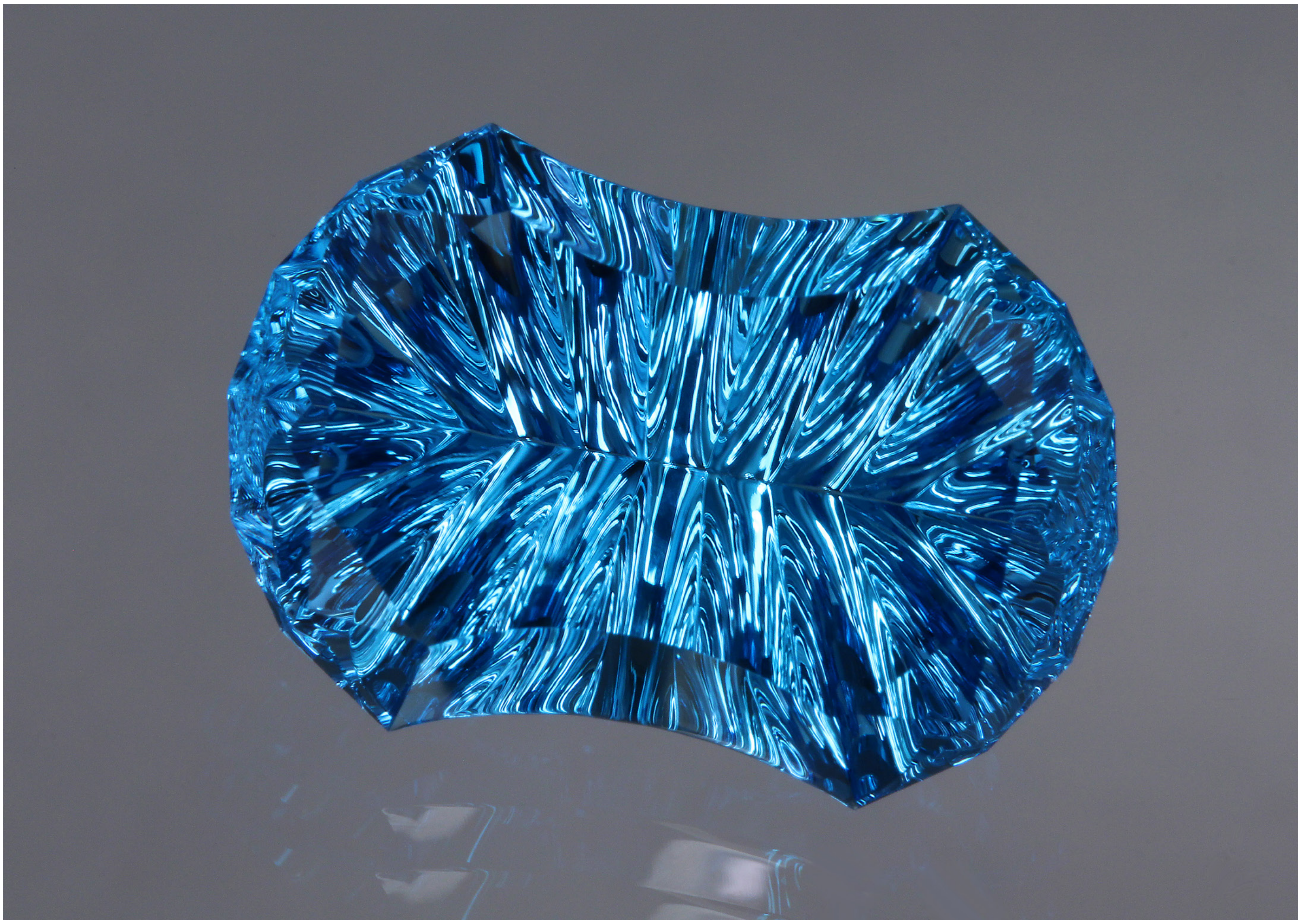


Tanzanite in ZigZag™ cut 13.67 carats (Photo by David Dyer)

Ametrine Dreamscape™ 34.77 carats (Photo by Lydia Dyer)



Bi-colour Tourmaline ZigZag™ 17.33 carats (Photo by Lydia Dyer)

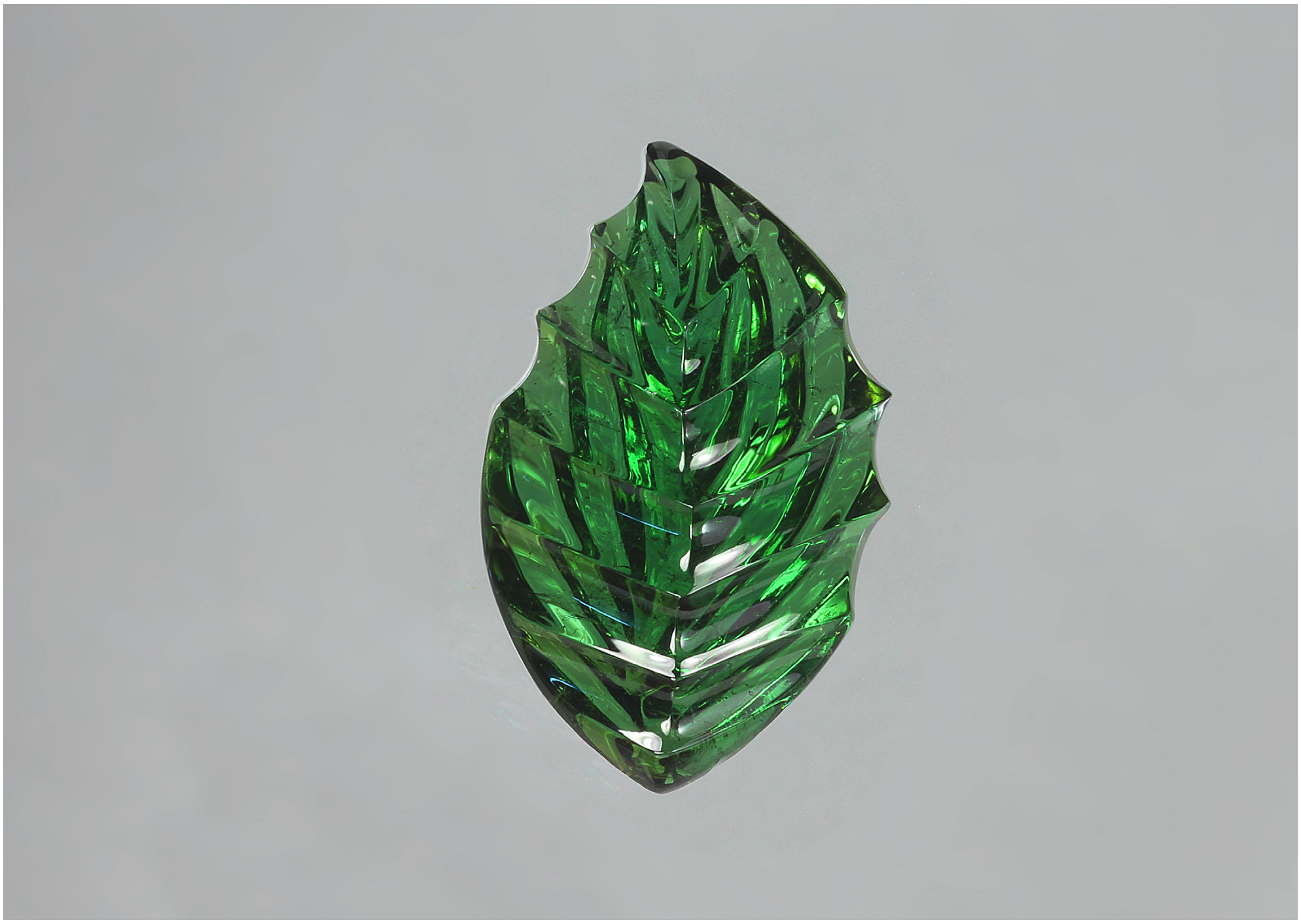


Irradiated Blue Topaz Concave Cut 18.72 carats (Photo by Priscilla Dyer)

Citrine Dreamscape™ 30.82 carats (Photo by Lydia Dyer)

Untreated Danburite StarBrite™ Cut 6.22 carats (Photo by David Dyer)

Golden Beryl Sculptural Gem™ 9.52 carats (Photo by Lydia Dyer)

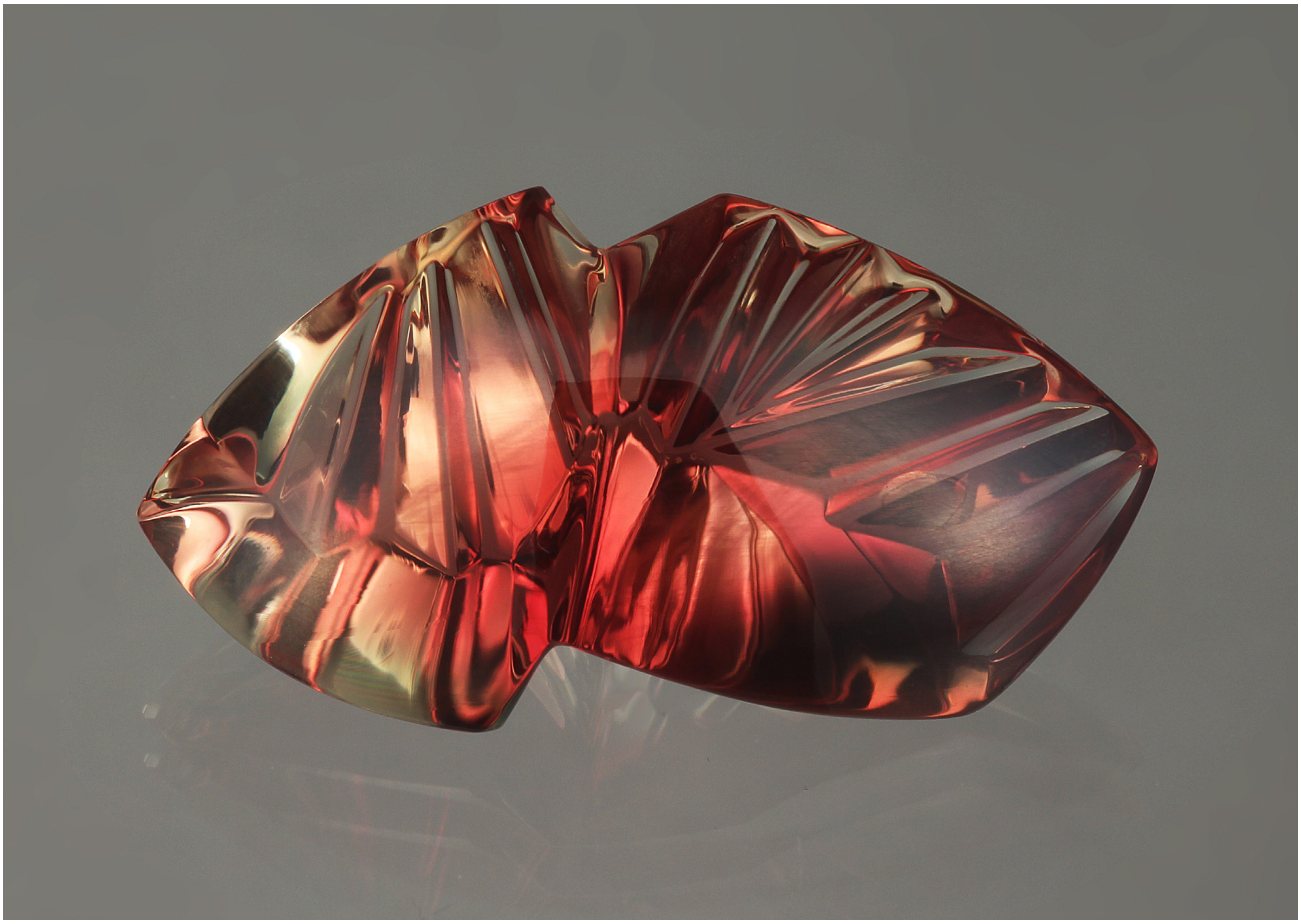


Leaf Shape Green Tourmaline 11.17 carats (Photo by David Dyer)

Tourmaline Regal Radiant ™ 6.41 carats (Photo by Lydia Dyer)

Parti-Colour Sapphire SunRay™ 1.82 carats (Photo by Priscilla Dyer)

Rhodolite Garnet Dreamscape™ 3.38 carats (Photo by Lydia Dyer)



Untreated Multi-Colour Oregon Sunstone in a Sculptural Gem ™ 27.47 carats (Photo by David Dyer)

Untreated Violet Sapphire StarBrite™ 13.47 carats (Photo by Priscilla Dyer)

Money Cent$

Economics for Non-Economists

GEOFF DOMINY is an author, independent gemmologist and founder of the World Gem Foundation. He received his F.G.A through the Gemmological Association of Great Britain (Gem-A) in 1987 passing the diploma examinations with distinction.

The NAME is the GAME

Chrome Green Tourmaline (Photo by Tino Hammid)

Many years ago a client came into my office interested in purchasing a two-carat emerald. During our initial meeting and with the help of my GemSet Coloured Gemstone Grading system, it soon became clear that what she wanted and what she could afford were two completely different things. I immediately switched gears and started to discuss other 'green' gemstones including tsavorite garnets, chrome green tourmalines and Chatham emeralds. From her reaction, she seemed more interested in the 'look' (Green) rather than the 'name' (Emerald) and was quite willing to explore the 'other' options.

The following week she came back to my office to look at the ring designs we had discussed and to view a two and a half carat tsavorite garnet and a two carat chrome green tourmaline. She immediately fell in love with the latter. The colour, to the untrained eye, was very close to the 'GemSet' samples she had selected, it looked remarkably like a fine emerald and the price fit perfectly into her budget.

Two weeks later, she picked up the ring and seemed thoroughly pleased with it.

A week later I received a phone call from one of my students who was working at a local jewellery store. She asked me when I had started selling Chatham Emeralds. I told her that while I admired them, I had never sold one and asked her why. She explained that a client had just come into her store with a Chatham Emerald and Diamond ring with my trademark stamped inside the ring. I quickly realised that the client who had just left her store was the very same client who had purchased the chrome green tourmaline and diamond ring from me a week earlier.

I have to admit that I was confused. While we had talked about Chatham emeralds, we had also talked at great length about the chrome green tourmaline, where it had come from and in this case, a more detailed history of the stone since my friend had purchased the rough and cut it.

I decided to call her but wondered how I would approach the subject without us both feeling uncomfortable.

We chatted for a few minutes and then I decided to relay what my student had told me. She laughed and said that nobody knew what a chrome green tourmaline was so she was telling everyone it was a Chatham emerald. While she agreed that her friends did not know what she meant by the word 'Chatham', they were all familiar with the word 'emerald'.

I ended the conversational with mixed feelings. I was happy that there had not been any miscommunication but not so happy that she was telling her friends that the stone was in fact something entirely different.

Rightly or wrongly we live in a society where image is everything, a world where we are judged not by who we are but by who we are perceived to be. A big house, a fancy car, expensive jewellery and designer clothes all scream out to our peers that we are successful. We may be up to our necks in debt but since we don't walk around with our bank and credit card statements pinned to our backs; who will ever know?

Somebody once gave me some extremely valuable advice and I have made it my mantra to this day. ‘If you don’t need to spend it, you don’t need to earn it’. I know this sounds quite organic and immediately conjures up images of a hippie, living in a commune, smoking weed and listening to the Doors but in reality, more and more people are embracing this new lifestyle; freeing themselves from the endless cycle of life where they work to live rather than live to work. People aren’t just stepping off the treadmill of life; they are jumping off it in droves.

I remember working for an auction house where there was a great deal of excitement surrounding the upcoming sale of a full set of Andy Warhol ‘Mick Jagger’ screen prints. A prominent and very wealthy client was having serious financial woes and had instructed the auction house to liquidate the set on one very important proviso; that the auction house provide him with ‘prints’ of the screen prints that could be remounted into the picture frames and rehung in his house so that nobody would be any the wiser. I often wonder what his heirs will say when he passes away and they gleefully arrange for the sale of the prints only to find out that the originals are all fakes. Of course, one often wonders how many wealthy people are walking around with diamond jewellery dripping with cubic zirconia.

As a former appraiser, it was not uncommon to find a cubic zirconia worth a few dollars set into a designer ring encrusted with micro-pave set diamonds that cost $ 10,000. Made clearly for clients who wanted the prestige of the ‘brand’ but could not afford to buy a real diamond to complete the illusion.

This leads me to the question of what motivates a person to buy something. In the case of gemstones, the big four (diamonds, rubies, blue sapphires and emeralds) are still very much the big four. Unfortunately as the prices have gone up, the quality has gone down. Instead of giving our clients options that are just as beautiful, sometimes rarer but not as well known, we instead sell stones that have been treated to give the ‘look’ of a stone of considerably higher value. A glass-filled ruby instead of a red spinel, a heavily oiled emerald instead of a tsavorite garnet or a chrome green tourmaline, an included blue sapphire instead of a tanzanite? The list goes on…….

Understanding what motivates a buyer can go a long way to understanding what you should be selling them. Most salespeople are blissfully unaware that every successful sale goes through the same steps (called the ‘The Anatomy of a Sale’), where the salesperson extols the features and benefits of the item they are selling, overcomes any objections that the client might have, asks for the sale, closes the sale and then suggests add-ons. It’s not rocket science but it is a proven system that successful salespeople use time and time again.

Perhaps that client who wants to buy a blue sapphire is doing so because he thinks that it is the only ‘blue’ gemstone option available to him. Why not tempt him with a blue spinel, a tanzanite or something even more exotic such as a benitoite? You will not only educate your client but more importantly you will assert yourself as the ‘professional’. Price comparing tsavorite garnet, chrome green tourmaline or blue and red spinel with the jeweller at the other end of the mall will not be easy and if you have really sold him on the idea, he won’t be buying from somebody else.

In the chart on the next page, I have used non-origin and heat treated ruby and blue sapphire and non-origin, moderately treated emerald as the baseline. Using GemGuide’s January/February 2017 pricelist for a three-carat stone, we can see that the savings range from 4.35% to a staggering 97.62%.

So what does this really mean?

Well let us assume that our client has given the jeweller a budget and that translates into $ 2,000 USD that the jeweller can spend on the stone.

For a red stone, he could buy a two-carat ruby (Lower Good), a four-carat red tourmaline (Upper Extra Fine) or a three and a half-carat red spinel (Upper Good).

For a blue stone, he could buy a two-carat blue sapphire (Lower Fine), a four-carat blue spinel (Lower Fine) or a four-carat tanzanite (Upper Fine).

For a green stone, he could buy a two-carat emerald (Upper Good), a two and a half-carat tsavorite garnet (Upper Good) or a four-carat chrome green tourmaline (Upper Fine).

We can see that in all three examples, the jeweller can give the client a bigger and invariably better quality stone for the same amount of money.

In the case of the ‘red stones’, the client can double the weight (and more than double the size due to the lower specific gravity of tourmaline) and substantially improve the quality (Lower Good to Upper Extra Fine) if he sells him a red tourmaline.

In the case of ‘blue stones’, while the quality will not change, the client would receive a stone of double the weight if he selected either the blue spinel or the tanzanite.

In the case of the green stones, while the choice of a tsavorite garnet would not result in a substantial improvement in size or quality, a chrome green tourmaline would give a much bigger ‘look’ and a better looking stone.

We don’t need to reinvent the wheel; we simply need to give it a spin. We are blessed with a stunning array of coloured gemstones yet very few can be found in the showcases of jewellers around the world.

Some might consider it a gamble but I disagree. Of course you will need to retrain your staff and open their minds to the endless possibilities that are available to them but then again, how could that be a bad thing? After all this is not a new idea I am promoting but one that has been around for millions of years

Three Carat Comparision Chart - GemGuide January/February 2017

Gemstone	Upper Commercial	Upper Good	Upper Fine	Upper Extra Fine
Ruby (Non-Origin Specific / Heat Treated)	-	-	-	-
Red Tourmaline	- 91.25%	- 95.00%	- 95.48%	- 97.62%
Red Spinel	- 71.25%	- 85.00%	- 61.29%	- 71.23%
Blue Sapphire (Non-Origin / Heat Treated)	-	-	-	-
Blue Spinel	- 81.82%	- 74.07%	- 72.12%	- 73.33%
Tanzanite	- 59.09%	- 70.37%	- 81.73%	- 87.22%
Emerald (Non-Origin / Moderate Treatment)	-	-	-	-
Tsavorite Garnet	- 15.38%	- 4.35%	- 36.36%	- 29.41%
Chrome Green Tourmaline	- 61.54%	- 81.96%	- 90.91%	- 92.35%

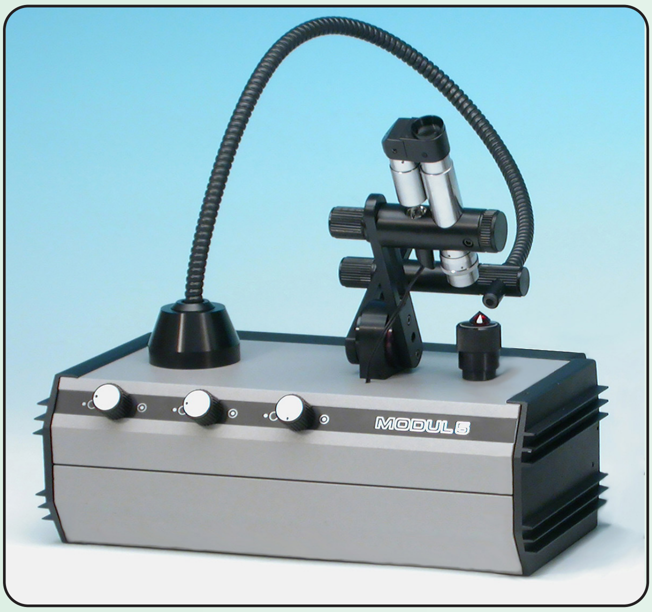
Tanzanite by Ekkehard Schneider weighing 10.47 carats (Photo by Jeff Scovil)

Tsavorite Garnet (Photo by Tino Hammid)

Tanzanian Red Spinel (Photo by Tino Hammid)

In this issue we look at the Prism Spectroscope, it's capabilities, limitations and why you should always have one at your disposal.

The Prism Spectroscope



Eickhorst Prism Type Spectroscope

While the refractometer can be used to identify roughly 80% of all known gemstones, the reverse is true about the spectroscope and while some may argue that it is somewhat limited in what it can do, it is important to remember that when it comes to the identification of gemstones, it is important to have a wide range of instruments at your disposal.

The phenomenon of selective absorption in gemstones can be made visible by using a spectroscope. This instrument uses either a series of prisms or diffraction grating to disperse white light into the visible colour spectrum. The spectroscope is used to identify characteristic dark bands caused by the absorption or partial absorption of certain colours of the visible light, which has passed through a gemstone.

In 1860, Giovanni Amici developed the Amici Prism, which consisted of three glass prisms; the outer two made of crown glass and the central inverted prism made of flint glass. This combination and arrangement of prisms was designed to produce near zero deviation of the yellow wavelength through the series of multiple refractions. It is these prisms that form the basis of a prism spectroscope.

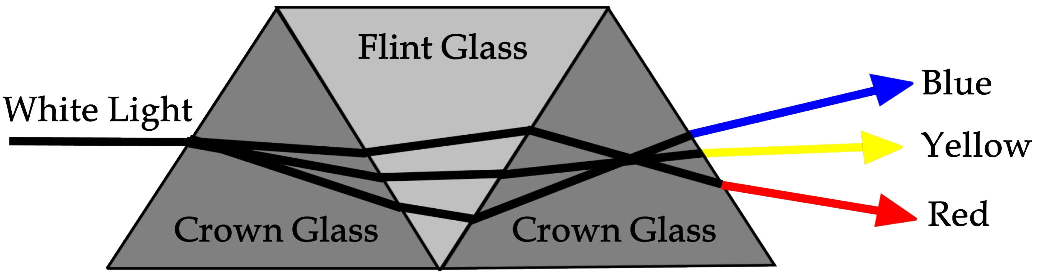
While it is somewhat limited in its use, unlike the refractometer, the spectroscope can be used on unpolished or rough stones, to identify treated or enhanced stones, faceted stones that are beyond the normal range of the refractometer, and can, in some cases, separate lab-created stones from their natural counterparts.

Unlike the diffraction grating model, they are however costly to buy and suffer from the fact that the wavelengths are not linearly spaced out with the red end bunched whilst the blue/violet end is spread out.

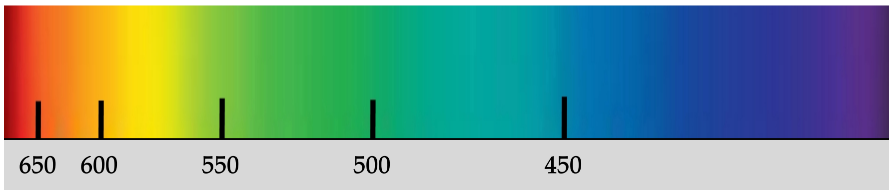
To use the prism type spectroscope, the user must adjust the slit width so that the resolution is appropriate to the spectrum being analyzed. It is recommended that the stone be immersed in cold water to cool it down and that a strong, cool and concentrated light source such as a fibre optic be used.

In the case of transparent gemstones, the light should be directed through the gemstone while with opaque stones, the light must be reflected from the surface.

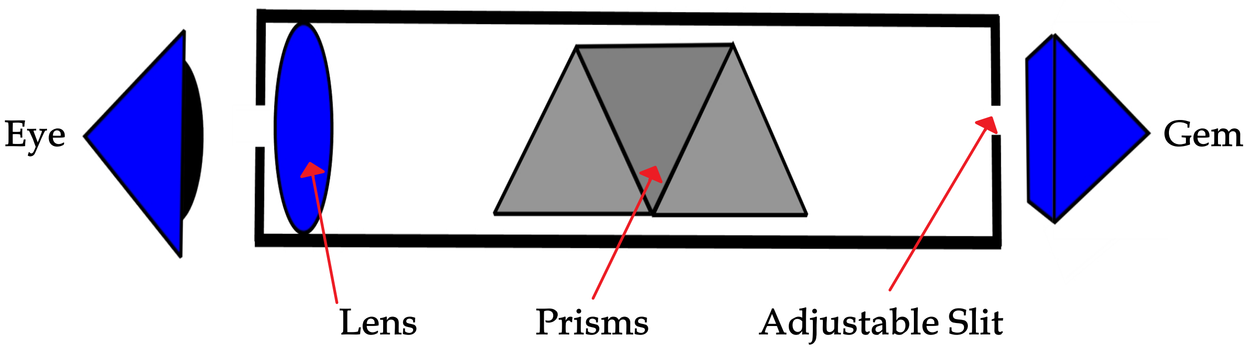
The spectroscope must be positioned in such a way so as to receive the light transmitted through or from the stone into the slit.



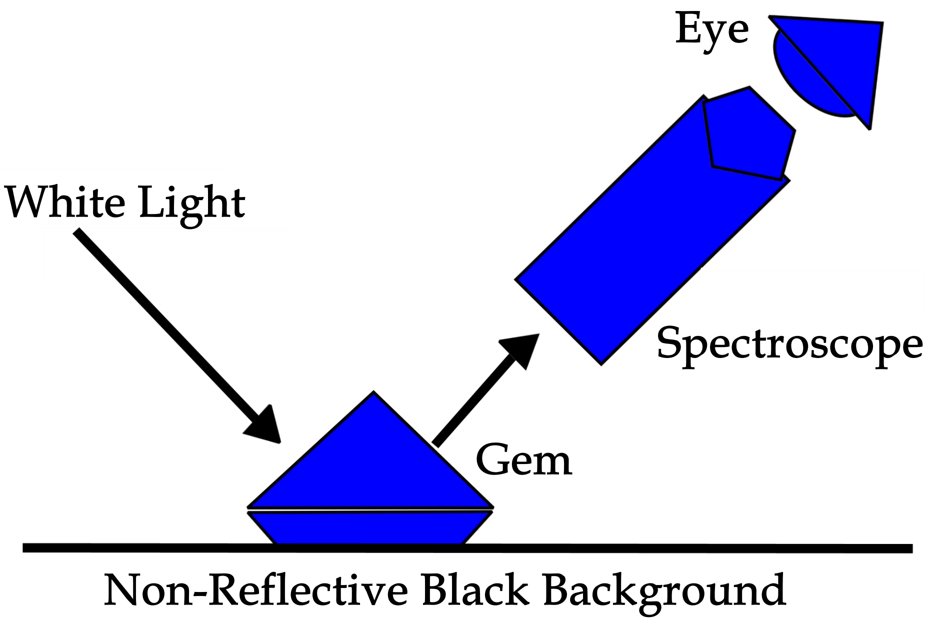
Amici Prisms



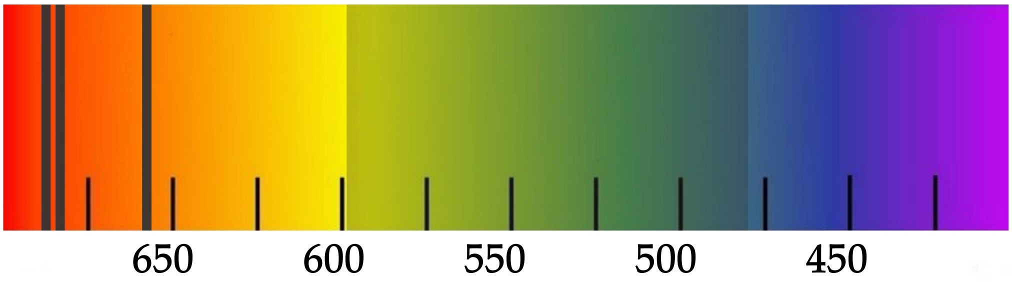
Prism Spectra



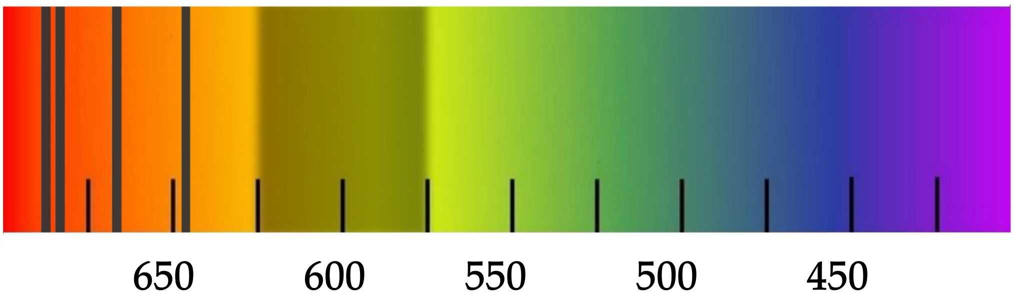
Prism Spectroscope



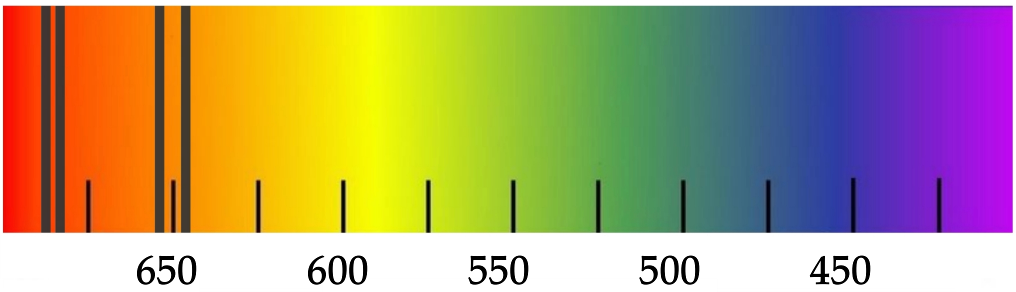
Correct Viewing Position



Red Spinel



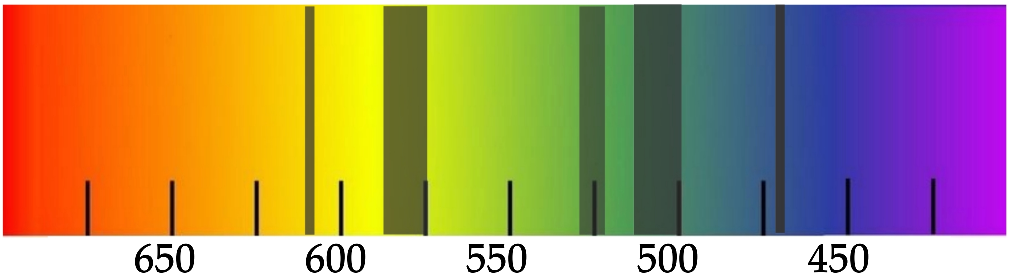
Emerald



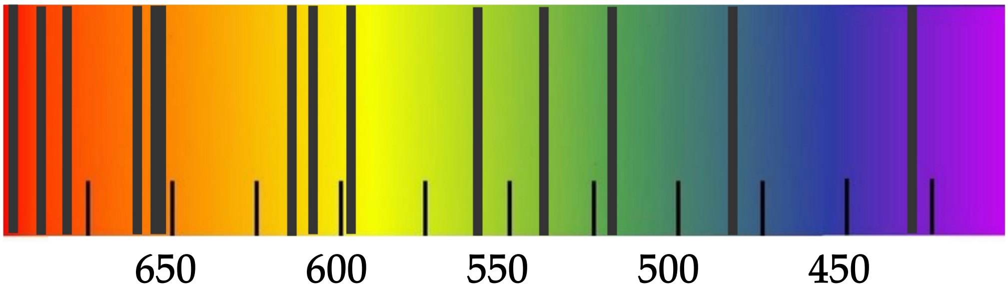
Alexandrite

Gemstone	Absorption Lines
Red Spinel	685, 684, 675, 665, 656, 650, 642, 632, 595 to 490, 465, 455
Emerald	683, 681, 662, 646, 637, 606, 594, 630 to 580, 477, 472
Alexandrite (Green)	680, 678, 665, 655, 649, 645, 640 to 655
Alexandrite (Red)	680, 678, 655, 645, 605 to 540, 472, 468

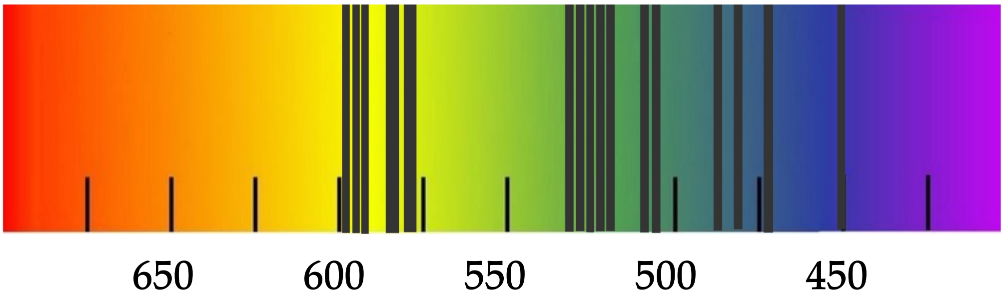
In chrome-rich natural emeralds and those produced in the laboratory, an absorption band at 477nm will also be seen.



Almandine Garnet



Zircon



Yellow Apatite

Gemstone	Absorption Lines
Almandine Garnet	617, 576, 526, 505, 476, 462, 438, 428, 404, 393
Zircon (High)	691, 689, 662, 660, 653, 621, 615, 589, 562, 537, 516, 484, 460, 433
Yellow Apatite	597, 585, 577, 533, 529, 527, 525, 521, 514, 469

These images have been computer generated, and are based on a diffraction grating spectrum. They are intended to simply show the relative position of the most prominent absorption lines for comparative purposes. The most prominent absorption lines are underlined in the accompanying summary charts.

For more detailed spectra, please refer to *The Spectroscope and Gemmology* by Basil Anderson and James Payne, edited by R. Keith Mitchell, or the work of John S. Harris at gemlab.co.uk.

The Fingerprint File
GEM IDENTIFICATION

In this issue we look at emeralds, their admirers and their detractors........

Emerald Eyes

Gemstone	R.I. Range	D.R.	D	O/S	S.G. Range	H
Garnet Topped Doublet	1.770 – 1.820	–	.027	I	3.93 – 4.30	6 ½ – 7 ½
Tsavorite Garnet	1.734 – 1.759	–	.020	I	3.57 – 3.73	6 ½ – 7 ½
Spinel Triplet	1.727	–	.020	I	3.54 – 3.63	8
Tourmaline	1.614 – 1.666	.014 – .032	.017	U-	3.01 – 3.11	7 – 7 ½
Hydrothermal Emerald	1.573 – 1.586	.007	.014	U-	2.68 – 2.70	7 ½ – 8
Biron Emerald	1.570 – 1.578	.008	.014	U-	2.68 – 2.70	7 ½ – 8
Linde Emeralds	1.567 – 1.572	.005	.014	U-	2.67	7 ½ – 8
Emerald	1.565 – 1.602	.006	.014	U-	2.67 – 2.78	7 ½ – 8
Green Beryl	1.562 – 1.602	.004 – .010	.014	U-	2.66 – 2.87	7 ½ – 8
Flux Melt Emeralds	1.560 – 1.563	.003	.014	U-	2.65	7 ½ – 8
Lennix Emeralds	1.556 – 1.566	.003	.014	U-	2.65 – 2.67	7 ½ – 8

While natural emerald is imitated by a variety of gemstones including cubic zirconia, yttrium aluminium garnet, green zircon, green sapphire, alexandrite, tsavorite garnet, demantoid garnet, peridot, chrome tourmaline, green tourmaline, topaz, green beryl, almandine garnet-topped glass doublets, spinel triplets (sold as Soudé emeralds), and glass, in reality there are few gemstones that can compete colour wise with a truly fine quality emerald. Of these, only chrome green tourmaline, tsavorite garnet and lab-created emeralds can be considered serious challengers to this most noble of beryls.

Although chrome green tourmaline will also appear red under the Chelsea filter, the combination of its noticeable birefringence, evident when using magnification or on the refractometer, its higher refractive index (1.614 - 1.666) and higher specific gravity (mean 3.05) makes separation relatively straightforward.

Tsavorite garnet with a refractive index range of 1.734 to 1.759 is singly refractive and has a specific gravity that is considerably higher than emerald. Small accent stones can be quite challenging especially if the size or manner in which they are set prohibits the use of the refractometer, however, the combination of a dichroscope and a polariscope, if the setting permits, will confirm their isotropic nature.

Tsavorite garnet from Kenya and Tanzania will show prominent absorption lines at 610nm and 430nm, whereas stones rich in chromium will show a doublet at 697nm with weaker lines at 660nm and 630nm, and diffused lines at 605nm and 505nm although the latter may be difficult to see.

Emerald, on the other hand, has a strong doublet at 683nm and 681nm, two weaker and more diffused lines at 662nm and 646nm, another line at 637nm, and a broad absorption in the yellow from 630nm to 580nm, leaving the green portion of the spectrum unabsorbed. In chromium-rich emeralds, a narrow line at 477nm may also be visible.

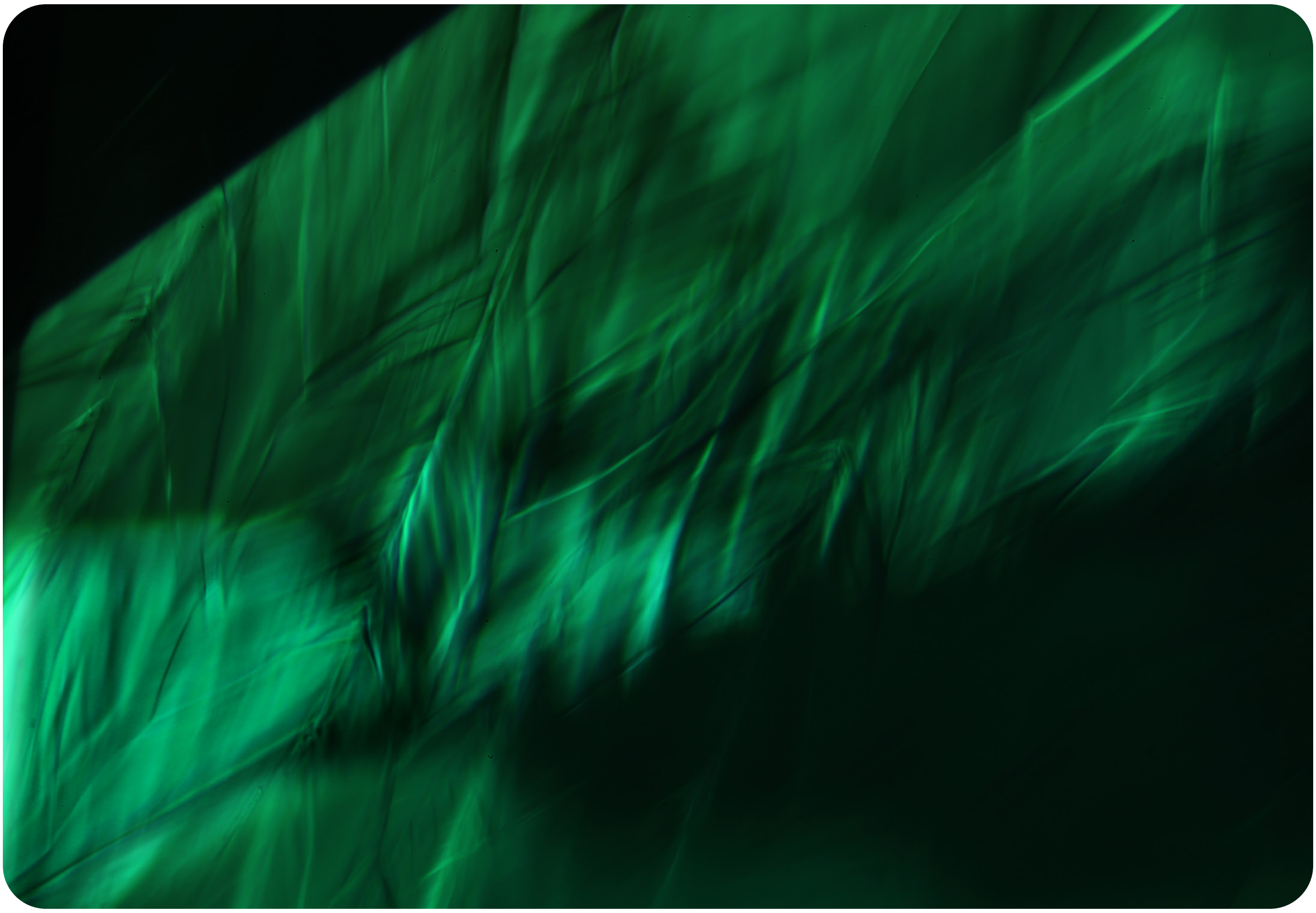
Soudé emeralds, consisting of either a crown and pavilion of colourless quartz or spinel fused together by a green epoxy are frequently encountered. Both however will give refractive index readings that are uncharacteristic of emerald with the spinel triplets exhibiting one shadow line instead of two. Immersion in either methylene iodide, in the case of lab-created spinel or an immersion liquid calibrated to an R.I. similar to quartz will also reveal their true composite nature.

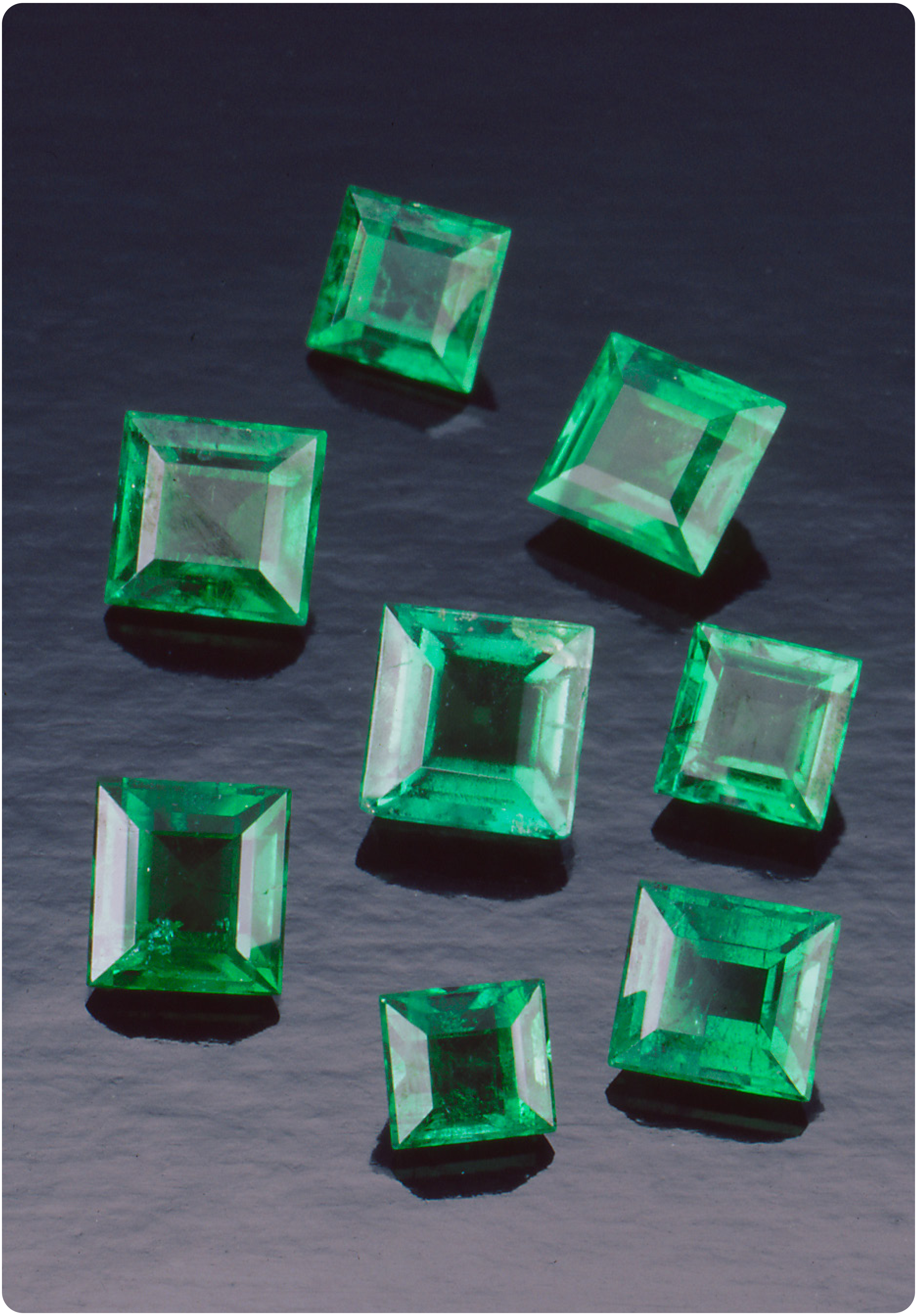
Garnet-topped glass doublets can also be confused with emeralds, however due to the almandine garnet crowns or partial crowns, one can expect a negative reading on

Natural Emerald (Photo by Jeff Scovil)

Biron Hydrothermal Emerald Crystal (Photo by Tino Hammid)


Pair of Natural Emeralds (Colombia) (16.14cts T.W) (Photo by Tino Hammid)


Hydrothermal Emerald (Photo by Hadi Nemati - Iranian Gem Society)


Sandawana Emeralds (Photo by Tino Hammid)

the refractometer. Stones will also exhibit inclusions that are characteristic of almandine garnet, a 'drag' response when a N52 magnet is applied to the crown, and the characteristic 'red halo' effect when viewed table down on white paper and illuminated from above.

Lab-created Emeralds

Prior to the manufacture of man-made emeralds in the 1940's, the Chelsea filter was used extensively to separate emeralds from its many simulants. Consisting of two gelatin filters, one that transmitted deep red wavelengths around 690 nanometres, and the other that transmitted yellow-green wavelengths around 570 nanometres, the filter was designed to coincide with the emissions and absorption of emeralds.

However once lab-created emeralds, also containing chromium, were introduced, the usefulness of the Chelsea filter diminished. While it was still possible to rapidly separate emeralds from its many simulants, it was no longer possible to prove conclusively whether or not a stone was man-made or natural.

Flux Melt Emeralds

Flux melt emeralds will generally have slightly lower refractive indices, 1.560 to 1.563 with a birefringence of -.003, compared to naturals with refractive indices of 1.565 to 1.602 and a slightly higher birefringence of -.006. They will also have a lower specific gravity of 2.65 compared to 2.67 to 2.78 (mean 2.71) for naturals. This is due to the lack of iron oxides in flux melt emeralds, which tend to corrode the platinum crucibles and can sometimes contaminate the stones with small hexagonal or triangular platinum inclusions.

Recently, in an attempt to produce stones with R.I's and S.G's that are closer to those of natural emeralds, producers have started to add small amounts of iron. The addition of iron oxides also tends to suppress fluorescence and makes the stones less transparent to UV light. Phenakite, a mineral consisting of beryllium silicate (Be_2SiO_4) is often found in flux melt emeralds appearing as small crystals, formed as a by-product of the supersaturated beryllium silicate solutions used to produce these stones.

Chatham Emeralds

A majority of stones are characterized by the presence of primary or secondary white to dark brown flux or veil-like inclusions resembling thinly dispersed cigarette smoke, phenakite crystals, needles or platelets of platinum, a rather saturated colour, a more pronounced absorption spectra due to the addition of chromic oxides, and a pronounced and a pronounced phosphorescence when exposed to x-rays.

Earlier Chatham emeralds exhibit a distinct red fluorescence under UV light, a brighter red under the Chelsea filter, and are more transparent to short wave UV light, often, freely transmitting down to 230nm.

More recent stones, due to the addition of iron oxides, will show less pronounced fluorescence and may not be as distinctly red under the Chelsea filter; they are also less transparent under short wave UV light. Some stones may exhibit anomalous double refraction under crossed polars, similar to flame fusion spinel.

Gilson Emeralds

Gilsons tend to have similar characteristics to Chathams with some stones, from the original 'N' series of crystals, containing iron oxides showing a characteristic absorption band at 427nm. Again wispy veil-like inclusions or phenakite inclusions are often seen under magnification. Stones appear a dull red under the Chelsea filter, exhibiting orange fluorescence under short wave UV light and dull mustard to greenish-yellow fluorescence under long wave UV radiations. Earlier stones, free of iron oxides, will be more transparent under short wave UV light and will have pronounced phosphorescence when exposed to X-rays. As with Chatham emeralds, some stones will exhibit anomalous double refraction.

Lennix Emeralds

Lennix emeralds are characterized by their unique response to cathodoluminescence producing a purple or bright violet-blue light. Other features include liquid feathers that may consist of two-phase inclusions.

Seiko Emeralds

Seiko emeralds are characterized by dust-like particles near the surface, together with twisted two-phase inclusions, planes of radiating phenakite crystals along with single crystals and coloured growth bands parallel to the table facet.

Zerfass Emeralds

Zerfass emeralds, produced by Walter Zerfass of Idar-Oberstein, are quite rare and highly collectable. They often have quasi-hexagonal honeycomb arrangements of veil-like feathers, when viewed in the direction of the optic axis with short tapered tubes parallel to the c-axis probably standing on minute phenakite crystals.

Inamori Emeralds

Inamori emeralds contain brownish-black flux inclusions (as opposed to whitish flux inclusions found in Chathams), tend to have a higher lustre and will exhibit physical and optical properties within the range of natural emeralds (J.Reynolds - Kyocera Corporation).

Hydrothermal Emeralds

In early hydrothermal emeralds, one can expect to see the seed crystal under magnification or when immersing the stone in a suitable immersion liquid. Often this results in the synthetic overgrowth being visible around the seed crystal. Hydrothermal emeralds are also characterized by a series of fine cracks, somewhat reminiscent of the crazing seen on pottery, on the surface, and growth lines.

Today, most hydrothermal emeralds do not contain remnants of the seed plate, however, one can still expect to see a wide range of inclusions including dust-like crystals near the junctions, phenakite crystals, large two-phase inclusions, nail-like inclusions with the head being a phenakite crystal (typically found in Linde emeralds), phantoms caused by crystal growth anomalies, chevrons, tiny crystallites of gold from the crucible lining in Biron hydrothermal emeralds, gas and liquid phases, comet-like white particles, parallel needle-like structures, veils of flux (seed crystal), and dark metallic inclusions.

In general, the refractive indices of hydrothermal emeralds will be similar to those seen in other lab-created emeralds. However, in extreme cases, where the synthetic overgrowth on early hydrothermal emeralds may have been partially removed during the polishing process or even through normal wear and tear, an erroneous R.I reading may occur corresponding to the seed crystal rather than the stone itself.

Hydrothermal emeralds, along with other hydrothermally produced gemstones, will also show a layered or Venetian blind effect caused by the successive layers of overgrowth and greater thermal conductance, compared to natural emeralds, when tested with an ALPHA-TEST Digital Readout thermal tester.

Stones coloured by vanadium will produce a characteristic absorption band at 610nm while showing an absence of any chromium lines. These stones will also show noticeable banding, due to the successive layers of growth, when immersed in a diluted bromoform solution.

Regency & Linde Hydrothermal Emeralds

Regency and Linde hydrothermal emeralds are characterized by unusually high levels of fluorescence under both short wave and long wave UV light, with noticeable fluorescence often noted when exposed to a high intensity white light.

Tairus Hydrothermal Emeralds

According to research conducted by Schmetzer, Schwarz, Bernhardt and Häger (Journal of Gemmology, 2006, Vol. 30, Nos 1/2, 59-74), the new vanadium/copper Tairus lab-created emeralds have refractive indices of 1.576 – 1.578 (ordinary) and 1.570 – 1.571 (extraordinary) with a birefringence of 0.006 to 0.007. The specific gravity is between 2.68 and 2.69.

Stones are inert under both short and long wave UV light and show a bluish-green colouration parallel to the c-axis and a yellowish-green colouration perpendicular to the c-axis. This is consistent with vanadium and copper-bearing hydrothermally grown beryl. Absorption bands in the UV-Vis-NIR range include bands at 1180nm, 920nm and 750nm attributed to copper and bands at 645nm, 605nm, 430nm and 395nm caused by vanadium with an additional band at 680nm that may also be attributable to vanadium.

Under magnification, there was no evidence of a seed plate, however, all samples showed step-like growth features related to weak colour zoning. Although relatively inclusion free, some samples exhibited tiny opaque crystals or thin platelets with a metallic lustre. These were identified as native copper. An infra-red spectrum showed that water was present which is consistent with both hydrothermal and natural emeralds and provides a definitive way of separating these stones from those produced using the flux melt method.

Treated & Enhanced Emeralds

Oiling

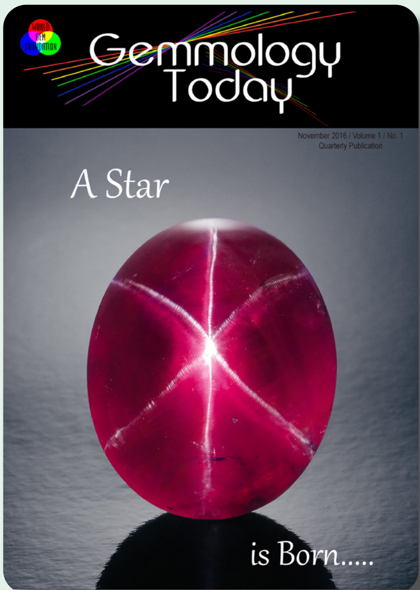
Emeralds are typically found with numerous surface reaching fissures making them ideal candidates for oiling. Common oils and epoxies include Canada balsam, a natural resin with an R.I. of 1.53, Opticon, an epoxy resin with an R.I. of 1.545, Excel (which replaced Gematrat in 2003) with an R.I of 1.52, and cedar wood oil with an R.I. of 1.50 to 1.51.

Oiling can be performed in two ways using either colourless oil to improve the appearance or coloured oil to improve the appearance and the value.

The first method involves simply soaking the stone in an oil of similar refractive index. The second requires cleaning the stone with hydrochloric acid and then a mild detergent. The stones are then soaked in oil that has been heated to decrease its viscosity and placed in a vacuum. This allows the oil to be introduced into the stone using a capillary action. After oiling, certain stones may be further heated at low temperatures to ensure a degree of stability.

Emeralds treated with resins and epoxies, such as Opticon and Excel, are generally treated for a prolonged period of time, often 24 hours, at temperatures around 95 degrees Celsius and then coated with a hardener to seal the stone.

Oiled emeralds can be identified by the presence of surface reaching unhealed fractures, the presence of colourless or greenish-yellow coloured residuals, and the possible bubbling or 'sweating' of oil from the stone if it is held under a halogen microscope lamp for a few minutes or by using a hotpoint. The presence of any coloured oils can be confirmed using a cotton swab. Bubbles may also be evident, trapped as the oil was introduced into the cracks, and sometimes, the oils will fluoresce under long wave UV light. A drop of acetone applied to the surface of an oiled stone will dissolve the oil, but, in the case of polymer treated stones this will produce a negative result. The identity of the actual substance used to infiltrate the stone can only be conclusively made using sophisticated equipment such as an infrared spectrophotometer or micro Raman spectrophotometry.



To check out the November 2016 issue, please click on the image above

Submissions

If you would like to submit an article to Gemmology Today, we would love to hear from you.

The deadline for the next issue is
July 15th, 2017

Guidelines:

- We do not accept highly scientific articles. These are better suited to 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
- We reserve the right to refuse articles

E-mail all submissions to information@ worldgemfoundation.com.

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. Others decide to work in more defined areas such as the pearl, opal or jade sectors.

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.

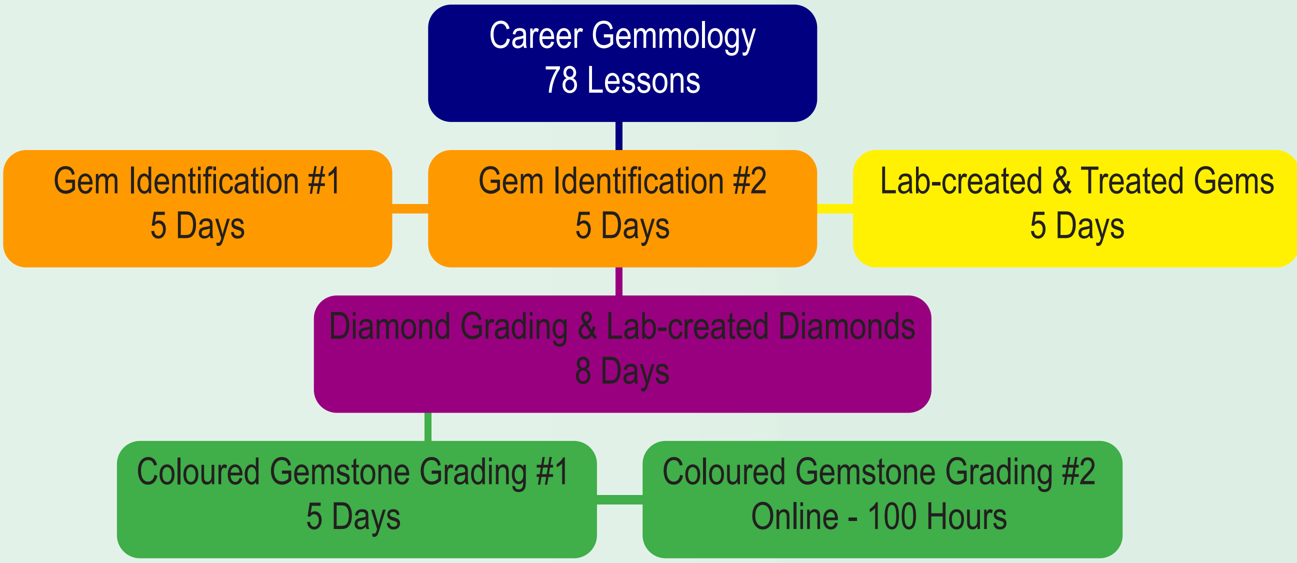
From there we move into the most challenging and fluid areas of gemmology; imitation and composite gemstones, lab-created gemstones and the treatment and enhancement of gems.

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.

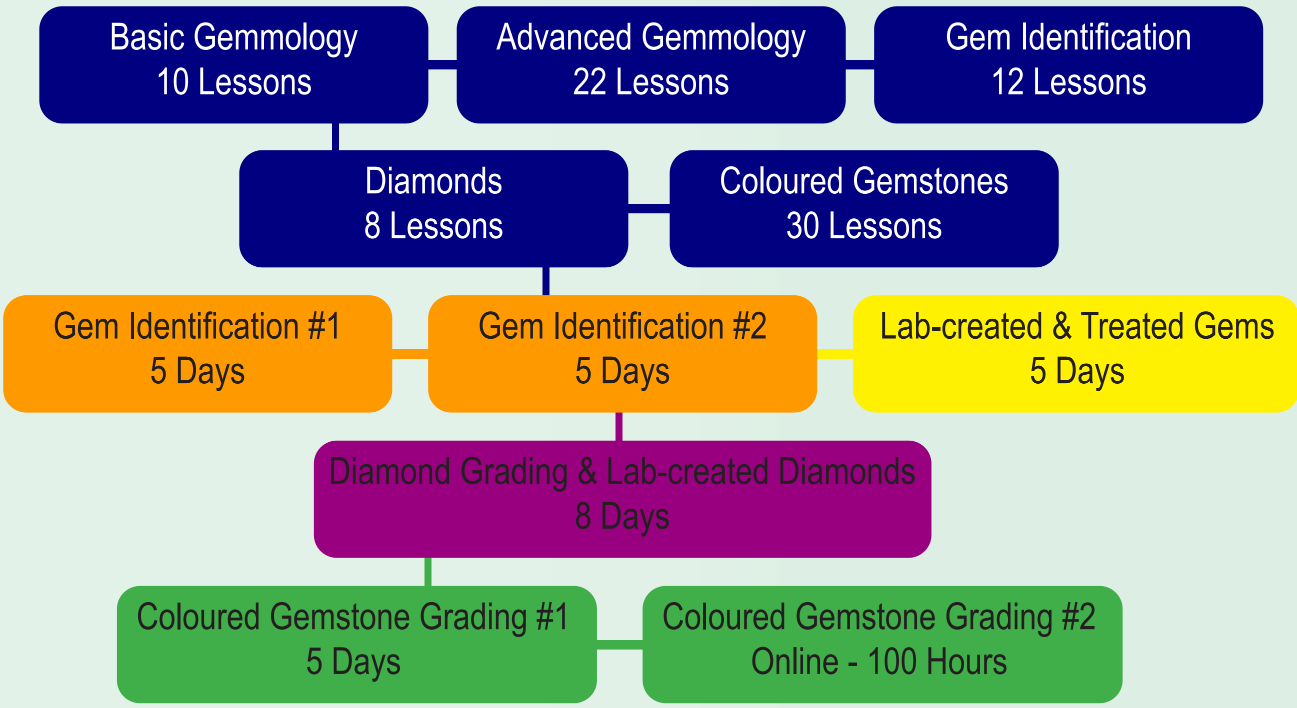
The use of treatments and enhancements is both demanding and depending on who you talk to, highly controversial. Here we look at not only the techniques used to treat and enhance gemstones (heat treatment, surface and sub-surface diffusion, lead glass fracture filling, flux assisted partial fissure healing, 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,

GEMMOLOGY SEVEN PROGRAM



GEMMOLOGY ELEVEN PROGRAM



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 weight is assessed in a '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.

General Interest

For those interested in gemstones but not wishing to take either the Gemmology Seven or Eleven programs, all of our theory courses can be taken independently without prerequisites. In addition to the six courses (Career Gemmology, Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones), we also offer two other 'General Interest' courses (Opals and Jade and Organic Gems).

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

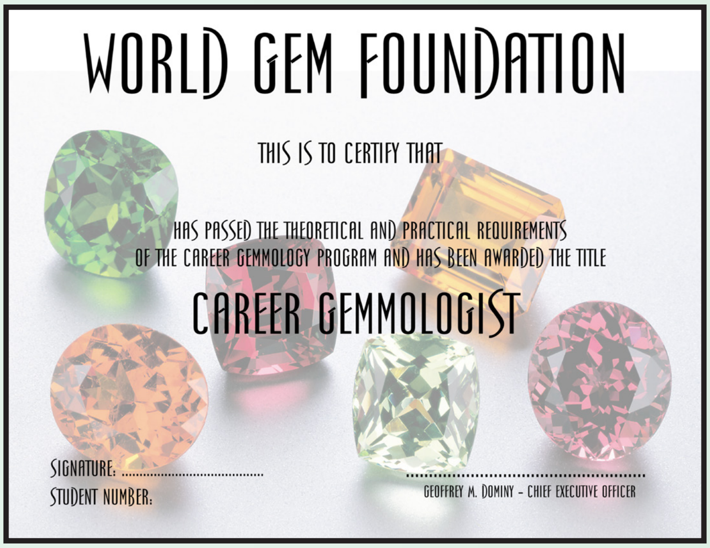
This course explores a very select group of gemstones (coral, jet, amber, ivory and pearls), formed through organic processes rather than through geological forces deep within the earth's surface. Lessons cover their physical and optical properties, geological formation, crystal systems, chemical composition, 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.

Individual Course Pricelist 2017

	Digital Option			Print Option		
Course Name	Euros	Pounds Sterling	USD	Euros	Pounds Sterling	USD
Basic Gemmology	200	150	225	235	180	265
Advanced Gemmology	400	300	450	430	325	485
Gem Identification	225	175	250	255	200	285
Diamonds	225	175	250	255	200	285
Coloured Gemstones	500	400	550	565	450	625
Career Gemmology	1400	1100	1600	1570	1235	1795
Opals and Jade	75	60	85	95	75	110
Organic Gems	50	40	55	65	50	75

Practical Workshops & Examination Fees

Course Name	Euros	Pounds Sterling	USD
Gem Identification #1 - Practical	500	400	550
Gem Identification #2 - Practical	500	400	550
Coloured Gemstone Grading #1 - Practical	500	400	550
Coloured Gemstone Grading #2 (Online)	1000	800	1150
Diamond Grading/Lab-created Diamonds - Practical	1750	1400	2000
Lab-created & Treated Gems - Practical	500	400	550
Examinations Fees (Gem Identification & Final Exam)	350	275	395



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.

For more information please visit our website at www.worldgemfoundation.com

Career Gemmology
Practical Workshops

Diamond Grading & Lab-created Diamonds (8 Days)

This workshop includes practical instruction on how to clarity and colour grade diamonds, techniques to determine table percentage, crown angle, girdle thickness and pavilion depth percentage, how to access polish and symmetry and the identification of lab-created diamonds.

Coloured Gemstone Grading #1 (5 Days)

This workshop includes practical instruction on how to access the hue, tone and saturation of coloured gemstones and how to grade pearls, jadeite and opals. During this practical class three colour grading systems; GIA, GemDialogue and World of Color will be discussed.

Coloured Gemstone Grading #2 (100 Hours Online)

This online coloured gemstone course consists of a comprehensive overview of the GemeWizard Colour Grading System and includes practical exercises that are completed online and a six month subscription to their program.

Gemstone Identification #1 (5 Days)

This workshop covers the identification of red, pink, orange, yellow and green gemstones plus a section on crystallography.

Gemstone Identification #2 (5 Days)

This workshop covers the identification of blue, violet/purple, brown, black and phenomenal/unusual stones.

Lab-created and Treated Gemstones (5 Days)

This workshop focuses on coloured gemstones produced synthetically or treated to improve their appearance.

Sessions

Classes run from 9.00am to 12.30pm and 1.30pm to 4.30pm with scheduled coffee/tea breaks of 15 minutes. Students are required to supply their own 10X loupe and polishing cloth. All other equipment will be provided by the 'Host' Gem Academy.

Please Note: To complete the 'Career Gemmology' program and receive the diploma, students must complete the 'Career Gemmology' theory course or the five component theory courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds and Coloured Gemstones) plus all of the aforementioned practical workshops, the online Coloured Gemstone Grading course and the applicable examinations.

WORLD GEM FOUNDATION WORKSHOPS

For 2017, The World Gem Foundation has developed four one-day workshops and one four-day workshop that are designed to appeal to not only those who are new to our industry but also to 'seasoned' professionals. These fast-paced sessions cover a wide range of topics ranging from the complexities of grading both diamonds and coloured gemstones, to three coloured gemstones (rubies, sapphires and emeralds) that individually and collectively are the cornerstones of the coloured gemstone trade, to an area that is perhaps the most fluid and challenging (gemstone enhancements and treatments) and finally to a complete overview of the twelve primary gemstones that are typically sold in the trade.

Where and When?

The workshops will be offered in the United Kingdom, Holland, Spain, France, Germany & Sweden. The cost of each workshop is £ 100 (United Kingdom) or € 125 (Holland, Spain, Sweden, France or Germany).

Join our 'Gemnastics' four-day gemmological workout in Mallorca (September 28th to October 1st, 2017) or in London (November 6th to 9th, 2017). The cost is € 500 (Mallorca) or £ 400 (London).

For more information, please see the individual course profiles on the following pages.

World Gem Foundation Tuition Credits

If you would like to learn more about gemstones and the science of gemmology, we would like to help. If you enrol in any of these one-day workshops or our four-day gemnastics program, you will receive a 'tuition credit' equal to the value of the workshop towards the cost of any of our 'Career Gemmology' theory component courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds, Coloured Gemstones) or our complete 'Career Gemmology' program.

There has never been a better time to explore gemmology......

DIAMOND & COLOURED GEMSTONE GRADING

Where & When

Date	Location	City
May 8th	Holland	Laren
May 14th	United Kingdom	London
May 19th	Spain	Madrid
June 26th	France	St. Marie

COURSE CONTENT

This one day workshop will give you a thorough understanding of the grading techniques used to assess the quality of both diamonds and coloured gemstones. Topics covered include the 4 C's (colour, clarity, cut and carat weight), how they are measured and assessed, how to describe the colour of a coloured gemstone, the various colour grading systems currently used by professionals, the clarity classification of coloured gemstones based on their geological environments, and how cut is assessed.

WHO SHOULD TAKE THIS COURSE?

This course is designed for those with some previous jewellery or gemmological knowledge, such as jewellers, goldsmiths, gemmological students and those who are engaged in the wholesale trade.

WHAT WILL I NEED TO BRING?

Students need only bring their energy and enthusiasm, plus something for making notes. Everything else will be provided.

BOOK NOW!

To Reserve Your Place

Click Here

RUBIES, SAPPHIRES & EMERALDS

Where & When

Date	Location	City
June 23rd	Spain	Madrid
July 3rd	Holland	Laren
Sept 1st	United Kingdom	London
Oct 25th	Germany	Munich

COURSE CONTENT

This one-day course covers three of the most important coloured stones; ruby, sapphire and emerald. Topics covered include an overview of their physical and optical properties, principal sources, basic testing methods, how they are produced synthetically, common treatments and enhancements, care guidelines, how they are valued and helpful buying tips.

WHO SHOULD TAKE THIS COURSE?

This course is designed for those with some previous jewellery or gemmological knowledge, such as jewellers, goldsmiths, gemmological students and those who are engaged in the wholesale trade.

WHAT WILL I NEED TO BRING?

Students need only bring their energy and enthusiasm, plus something for making notes. Everything else will be provided.

BOOK NOW!

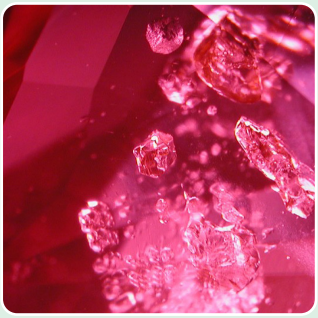
To Reserve Your Place

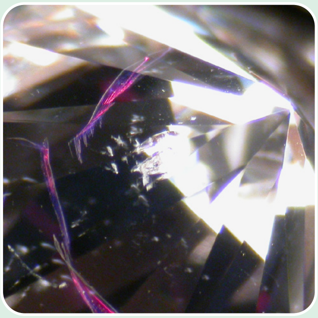
Click Here

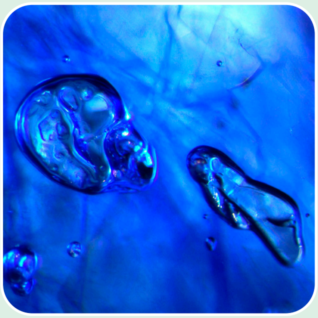
GEMSTONE ENHANCEMENTS & TREATMENTS

Where & When

Date	Location	City
Sept 2nd	United Kingdom	London
Sept 11th	Holland	Laren
Oct 26th	Germany	Munich







COURSE CONTENT

This one-day course covers one of the most fluid and challenging areas of gemmology; the enhancement and treatment of gemstones. Topics covered include 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.

WHO SHOULD TAKE THIS COURSE?

This course is designed for those with advanced gemmological knowledge who deal on a day to day basis with gemstones either at the wholesale or retail level or in the manufacturing process.

WHAT WILL I NEED TO BRING?

Students need only bring their energy and enthusiasm, plus something for making notes. Everything else will be provided.

BOOK NOW!

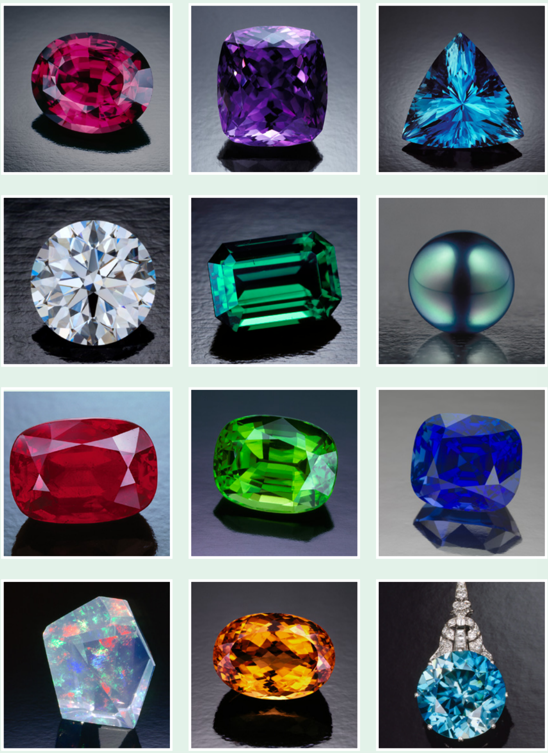
To Reserve Your Place

Click Here

BIRTHSTONES OF THE MONTH

Where & When

Date	Location	City
June 27th	France	St. Marie
Nov 6th	Holland	Laren



COURSE CONTENT

This fast paced workshop covers the twelve primary ‘Birthstones’ (garnet, amethyst quartz, aquamarine, diamond, emerald, pearl, ruby, peridot, sapphire, opal, topaz and zircon) and gives a general overview of their primary sources, how they are valued, helpful buying tips, how to care for them, common treatments and enhancements and basic testing methods.

WHO SHOULD TAKE THIS COURSE?

This course is an entry level course but will also appeal to jewellers and goldsmiths who would like to know more about the stones they are selling or using in the manufacturing process.

WHAT WILL I NEED TO BRING?

Students need only bring their energy and enthusiasm, plus something for making notes. Everything else will be provided.

BOOK NOW!

To Reserve Your Place

Click Here

MALLORCA

Sea, Sun, Sand and Gemmology

To Reserve Your Place

Click Here

GEMnastics

A four day gemmological workout

The Spanish Gem Academy is pleased to offer our four-day workshop in Mallorca on September 28th, 29th, 30th & October 1st, 2017.

This four-day workshop covers a variety of subjects ranging from how diamonds and coloured gemstones are graded, the twelve primary gemstones used in the trade to the fluid and challenging area of gemstone enhancements and treatments.

The workshop starts with the grading techniques used to assess the quality of both diamonds and coloured gemstones. Topics covered include the 4 C's (colour, clarity, cut and carat weight), how they are measured and assessed, how to describe the colour of a coloured gemstone, the various colour grading systems currently used by professionals, the clarity classification of coloured gemstones based on their geological environments, and how cut is assessed.

From there, we move onto the twelve primary 'Birthstones' (garnet, amethyst quartz, aquamarine, diamond, emerald, pearl, ruby, peridot, sapphire, opal, topaz and zircon) giving an overview of their physical and optical properties, principal sources, how they are produced synthetically, how they are valued, helpful buying tips and basic testing methods.

The workshop concludes with a complete overview of the enhancement and treatment of gemstones. Topics covered include 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.

TUITION CREDIT

The total cost is € 500 (including lunch)

All participants will receive a € 500 tuition credit towards the World Gem Foundation's Career Gemmology Course or any of the five component courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds or Coloured Gemstones)

A wealth of knowledge for a fraction of the price......

LONDON CALLING

To Reserve Your Place

Click Here

GEMnastics

A four day gemmological workout

The British Gem Academy is pleased to offer our four-day workshop in London on November 6th to November 9th, 2017.

This four-day workshop covers a variety of subjects ranging from how diamonds and coloured gemstones are graded, the twelve primary gemstones used in the trade to the fluid and challenging area of gemstone enhancements and treatments.

The workshop starts with the grading techniques used to assess the quality of both diamonds and coloured gemstones. Topics covered include the 4 C's (colour, clarity, cut and carat weight), how they are measured and assessed, how to describe the colour of a coloured gemstone, the various colour grading systems currently used by professionals, the clarity classification of coloured gemstones based on their geological environments, and how cut is assessed.

From there, we move onto the twelve primary 'Birthstones' (garnet, amethyst quartz, aquamarine, diamond, emerald, pearl, ruby, peridot, sapphire, opal, topaz and zircon) giving an overview of their physical and optical properties, principal sources, how they are produced synthetically, how they are valued, helpful buying tips and basic testing methods.

The workshop concludes with a complete overview of the enhancement and treatment of gemstones. Topics covered include 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.

TUITION CREDIT

The total cost is £ 400 (including lunch)

All participants will receive a £ 400 tuition credit towards the World Gem Foundation's Career Gemmology Course or any of the five component courses (Basic Gemmology, Advanced Gemmology, Gem Identification, Diamonds or Coloured Gemstones)

A wealth of knowledge for a fraction of the price......

Grade School

MICHAEL D. COWING is the author of Objective Diamond Clarity Grading, an educator, gemologist and appraiser operating an Accredited Gemologist Association (AGA) Certified Gem Laboratory. His career in the diamond, gem and jewelry business spans over 35 years.

Diamond Clarity Grading's 'Golden Ratio'

Fig. 1: 1.83 carat Round Brilliant Cut (Photo by Michael D. Cowing)

Clarity is a key quality factor, the purity aspect of the famous '4 Cs'. The 4 C's, (cut, color, clarity and carat weight) are the factors that are used by gem laboratories to evaluate and value cut and polished diamonds (Fig. 1).

The diamond clarity scale employed throughout the world in today's gemological laboratories uses grading terminology and inclusion definitions introduced by the Gemological Institute of America (GIA). In 1953, GIA established systems for both the colour and clarity grading of diamonds (Shuster, 2003).

GIA's clarity scale expanded upon terms and definitions that had evolved from trade usage going back more than a century. We know this thanks to Frank Wade, author of 'Diamonds, A Study of the Factors That Govern Their Value', 1915. Wade was the senior advisor in the 30's to GIA founder Robert Shipley, specializing in the field of diamond grading.

Wade talked of diamond imperfection in terms common in the trade at that time such as 'VVS., or very very slight', 'slightly imperfect' and 'imperfect'. GIA expanded this clarity grading terminology, as then President Richard T. Liddicoat Jr. noted, because 'There weren't a large enough number of grades to fit the market….we had to have more' (Shuster, 2003). The VVS grade was split into VVS$_1$ and VVS$_2$. Between VVS and slightly imperfect were two grades of VS$_1$ and VS$_2$. Slightly imperfect was expanded to SI$_1$ and SI$_2$ and imperfect to I$_1$, I$_2$ and I$_3$.

Clarity Grading Evolution

GIA's clarity scale and its diamond grading system have become the model for laboratories throughout the world. The terminology and definitions of this scale are universally used to communicate to the gem trade and consumers the clarity or purity aspect of diamond quality.

A significant problem with this clarity scale is its subjective nature. By subjective we mean the clarity grades are defined in terms that are subject to varying human interpretation. This is the opposite of objective where definitions are in terms that are not subject to human interpretation. For example, an objective aspect of clarity is a measure in millimeters of the size of inclusions.

Today, non-GIA laboratories commonly employ clarity scales and terminology that largely retain the nomenclature and definitions of the GIA system. These systems have evolved, and partly due to subjectivity, their implementations vary from GIA and from one another. This evolution has resulted in inconsistent grading from lab to lab and even within labs. Until now clarity grading standardization has remained an elusive goal.

Objective Grading System

Today, that goal is reached with the system of clarity grading introduced in my book 'Objective Diamond Clarity Grading' (ODCG). The System is comprised of objective metrics that are used to model the techniques of expert graders whose proficiency was obtained from extensive experience and practice. The many GIA graded diamond examples throughout the book demonstrate the accuracy and consistency of this system in matching the grade 'calls' of GIA.

To arrive at a clarity grade, the ODCG System evaluates the combined clarity factors in a manner that replicates the practice of experienced graders. At the heart of this 'System' is the discovery of two key aspects of the way professionals perceive inclusion visibility in judging the grade.

First, the increase in inclusion size from one grade to the next is not constant, but approximately follows a doubling of the inclusion's dimensions. That rough dimension doubling, which is a quadrupling in area, is surprisingly consistent from grade to grade across the clarity scale.

Second, the grade-defining property of inclusion visibility is directly related to inclusion area. If the major inclusions (called 'grade-makers') have the same area and only differ in their length and width, they are perceived to have similar visibility, and most often receive the same grade.

From the early GIA clarity scale representation (Fig. 2b), we see that the range or distances on the scale between the lower grades is significantly larger than the distances between the higher grades. However, based on the 2:1 ratio in size between grades, the actual increase in distance from grade to grade is even more pronounced, as shown partially in Fig. 2c.

This approximate 2:1 ratio in dimensions from one grade to the next across the clarity scale is a remarkable finding. We recognize from Wade that it came about through the natural evolution of clarity grading that began before GIA's formation, rather than by design or intent

This proportional relationship between grades was named the Clarity 'Golden Ratio' and 'Golden Spiral' by Gary Roskin, author of 'Photo Masters for Diamond Grading', because of its resemblance to the Golden Ratio and the resulting Golden Spirals in art, nature, and mathematics.

The golden spiral is a special kind of construction conforming to the golden ratio of 1.62:1. Although the ratio between chambers is not 1.62:1, the most pictured examples of the golden spiral in nature are the nautilus shell (Fig. 3), and its prehistoric fossil cousin, the ammonite (Fig. 6).

The golden spiral and ratio is often seen in growth patterns in nature, and even the proportions of the human body adhere to it. Objects that have golden proportions seem innately more beautiful to us.

Comparing the spiral of nature's creations like the nautilus to the clarity scale is noteworthy, but not because of the exact ratio. The important comparison is that each successive chamber or section increases in size by a constant proportion just as each successive clarity grade increases by the constant ratio 2:1.

The author cannot overemphasize the remarkable nature of the discovery of this approximate but consistent 2:1 ratio in dimensions from grade to grade across the entire grading scale.

This 'clarity golden ratio' between grades came about, not by design, but by a natural evolution and expansion of the clarity grading terms and their definitions used in the diamond trade well before GIA's founding.

Fig. 2a

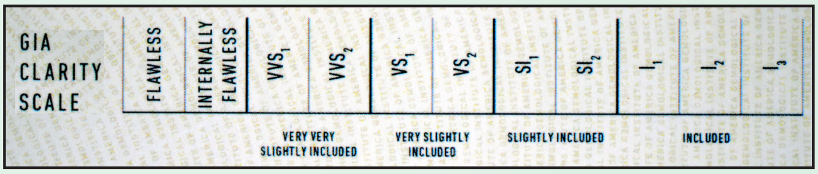


Fig. 2b

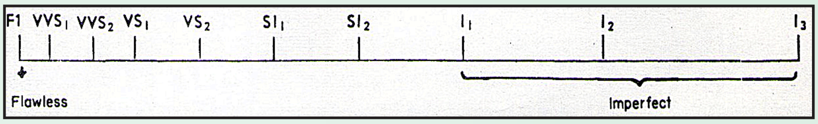


Fig. 2c

Fig. 2a: GIA's clarity grading scale (shown here from a recent diamond grading report) consists of 11 grades, ranging from Flawless to Included (formerly Imperfect).

Fig. 2b: This early representation of GIA's clarity scale (GIA, 1969) shows a greater increase in spacing from higher to lower grades.

Fig. 2c: This diagram shows the actual increase in spacing (and in inclusion dimensions) of a portion of the grading scale corresponding to a doubling in dimensions of grade-setting inclusions from one grade to the next lower grade.

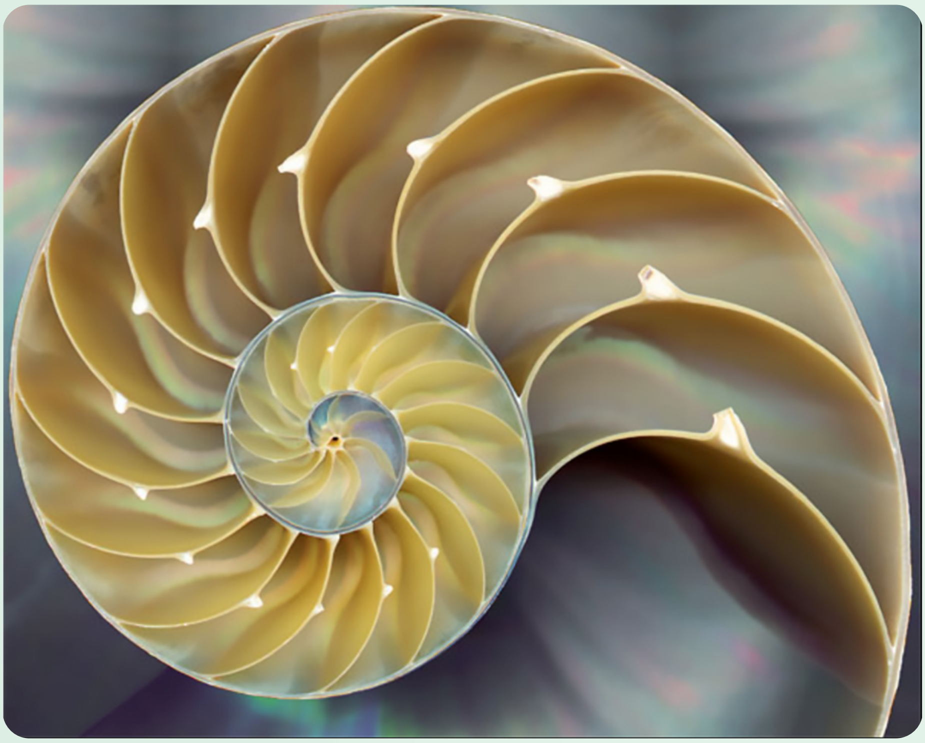


Fig. 3: Golden spiral in nature in the nautilus shell

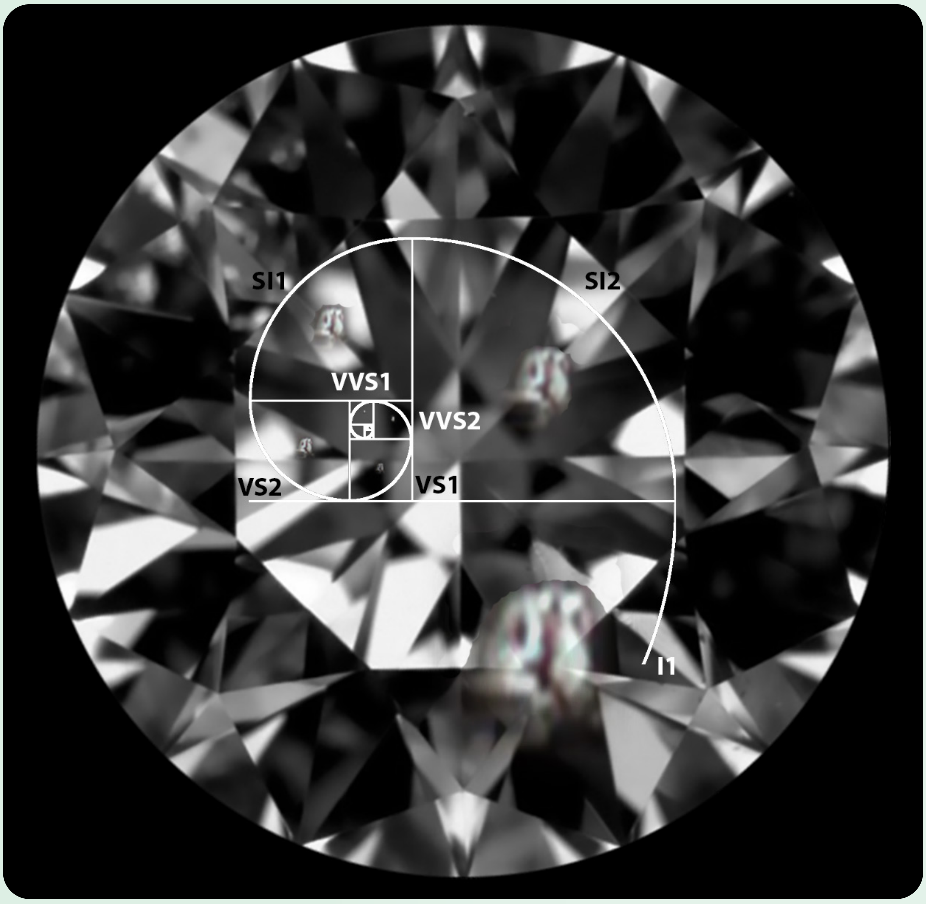


Fig. 4: Illustrating the relative increase in inclusion size from grade to grade is this spiral of seven inclusions digitally inserted in a 1.11 carat diamond shown at 15X. The inclusions are grade sizes from VVS_1 to I_1.

Conclusions

Like the Golden Ratio found in proportions in nature and art, the 'Clarity Golden Ratio' of 2:1 between grades is an emergent phenomenon of human perception of the comparative visibility of inclusions. This natural perception resulted in a scale of grades that double in dimensions rather than increasing in size by a constant amount. Human perception led naturally to grades that conform to the 2:1 Clarity Golden Ratio.

Attaining Accuracy and Consistency in a Subjective System

GIA says: 'it is important to remember that it is impossible to develop a precise description of any clarity grade except flawless….clarity grading is like appraising a painting: it is the overall picture that sets the clarity grade. Clarity grading is as much an art as an objective science; becoming really proficient at it takes time, experience and practice' (GIA, 1994, p. 2).

'Objective Diamond Clarity Grading' introduces a new objective form of clarity grading. It is comprised of objective metrics that succeed in modeling the grading techniques of expert graders. The system emulates the analysis performed by professional graders who assess the combined four factors of inclusion visibility to arrive at the grade call.

The more than one hundred diamonds presented in 'ODCG' demonstrate the application of this system to GIA and AGS laboratory graded diamonds. Accompanied by over 250 images, they are a random sampling of recently graded diamonds that support the success of this 'System' in matching GIA's expert grading.

Today, with the aid of this new objective method of clarity grading the beginning grader can leap frog the usual learning curve. With this 'System' the reader will soon be grading accurately and consistently at a professional level.

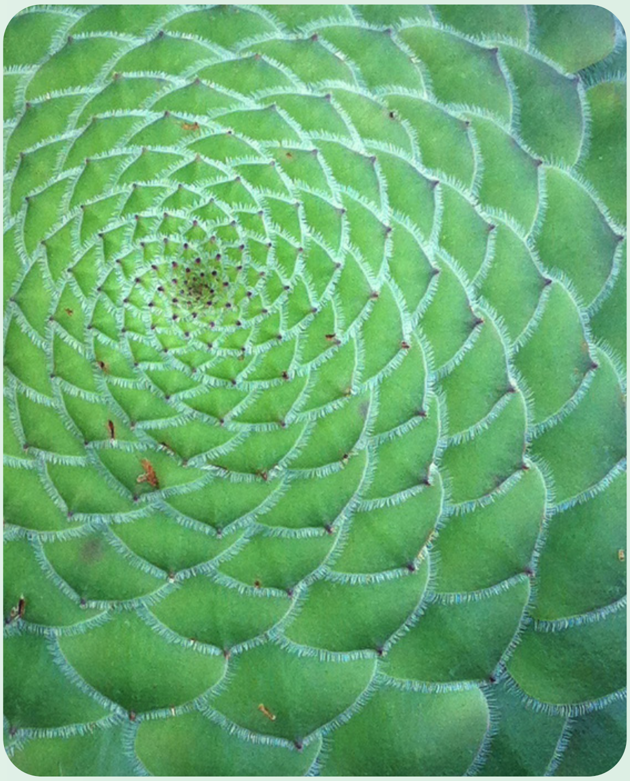


Fig. 5: Golden spiral in flat-topped aeonium

Fig. 6: Golden spiral in this agatized ammonite shell fossil (Photo by Michael D. Cowing)

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Made in Britain

SARAH STEELE is a Geologist, Gemmologist FGA,DGA and professional lapidary. Much of her time is now dedicated to research into the jet group of gems in order to protect the world's indigenous jet industries from the threats posed by unpoliced simulants. She is in the process of making her work a PhD thesis.

That Old Black Magic - Jet

In the 21st century we tend to think that there a few totally unknowns in the field of gemmology. There is one group of gemstones however, about which we know almost nothing – the Jet group. This is somewhat surprising as jet first appears in the archaeological record during the Palaeolithic 17,000 years ago in mainland Europe, and in the British Isles, Whitby Jet, arguably the best gem quality material in the world, first appearing in the Early Neolithic. This makes Whitby Jet, along with flint, Britain's oldest natural resource, and more importantly, jet working along with flint knapping, Britain's oldest craft.

As a degree qualified geologist, gemmologist and more importantly, a lapidary with 30 years' experience working almost exclusively in Whitby Jet, I should perhaps know more on the subject than most, the problem is however not that simple. I would argue that in order to move jet research forwards, we need to redefine the term 'jet' from the dictionary definition upwards.

If we look at the definition of jet, we find something along the lines of:

Jet is a form of fossilized wood. It is comprised of hydrocarbons with trace minerals, similar to that of lignite or brown coal.

or

Jet is opaque black coalified fossilized driftwood of trees of the Monkey Puzzle family, which is 180 million years old. Jet is chemically related to brown coal, or lignite, but Jet is more solid and tough.

These are pretty standard for the definition of jet, however there are a number of problems. Firstly, jet is demonstratively not lignite, and secondly there is evidence to suggest that multiple tree species are involved in its formation. Added to these issues the word 'jet' has become a generic term to cover a whole range of materials, which are vaguely black, polish easily and are used for decorative purposes seen primarily in Victorian mourning jewellery.

The problem is exaggerated further when we consider jet within an archaeological context with many papers having been written to aid the identification of jet within the archaeological record. This has resulted in a group of 'jet-like' materials, all of which are apparently like jet, despite the fact the list now includes oil shales, cannel coals, lignites, bog oak, devitrified glass, early vulcanized plastics and not to forget, true jet.

In Whitby, the lapidaries are often commissioned to make replica museum quality pieces for public display. Although we are happy to do this, we are often presented with a dilemma - the original artefact in our expert opinion, was not made from Whitby Jet. Voicing our concerns can make the archaeologist rather angry. The unfamiliarity of the archaeologist with the raw material leads them to require a test, usually FTIR, X-Ray, or reflectance testing. The lapidaries of Whitby however are primarily using visual identification techniques; colour, S.G, lustre, occurrence, surface palaeontological features, fracture, hardness, streak, stability, durability and surprisingly smell - i.e. all the attributes used by the gemmologist but for some frustrating reason these criteria are not being applied to the identification of jet materials. In my opinion these characteristics are unique, quantifiable and specific to the jet materials from individual sources.

Moreover, it is often possible for the Whitby lapidaries to identify the source of our jet to the exact locality it was collected from using these techniques yet, the experts tell us that it's not possible to distinguish between Whitby Jet and cannel coal? The problem is exacerbated when we look at the gemmological data for jet. We are confronted with a huge range of values, for example lustre is often defined as waxy to vitreous, hardness 2.5 to 4, stability poor to good and so on. This is pretty much nonsense; all true jets have very clear-cut parameters as do other gemstones.

The gemmological properties of jet almost certainly contribute to it's long and illustrious period of usage. I would argue that these parameters make jet a truly magical material and explain the obsession with it both historically and at the present day. It's high lustre, which is easily achievable and its ease of carving doubtlessly accounting for it's popularity in Prehistory. We also must consider the low specific gravity, which is quite a surprise if you aren't expecting it, its low thermal conductivity meaning it always feels warm and its triboelectric nature, meaning that like amber it carries a static electric charge. Perhaps more important is its ability to burn leaving very little residue – how better to dedicate an effigy to the ancient gods than with a talisman which with the application of heat burns with a green smoke before simply disappearing into the ether! Of course in the 21st Century, we can explain away these attributes scientifically, what I can't explain however is the basic desire to work jet as a material. There are jet working communities on many continents of the planet but we all share one primordial need to polish this material at the expense of all others. Jet culture and mysticism is embedded deep in our psyche it seems, but this way of life, and one of civilizations oldest traditions is now under serious threat. The lack of knowledge and research into the jet group of gemstones has lead to simulants being sold freely as indigenous jet in many countries.

Very distinct lustre difference between Whitby Jet (bottom) and a Siberian simulant (top), which is in fact a sapropelite or 'waxy coal' (Photo by Sarah Steele)

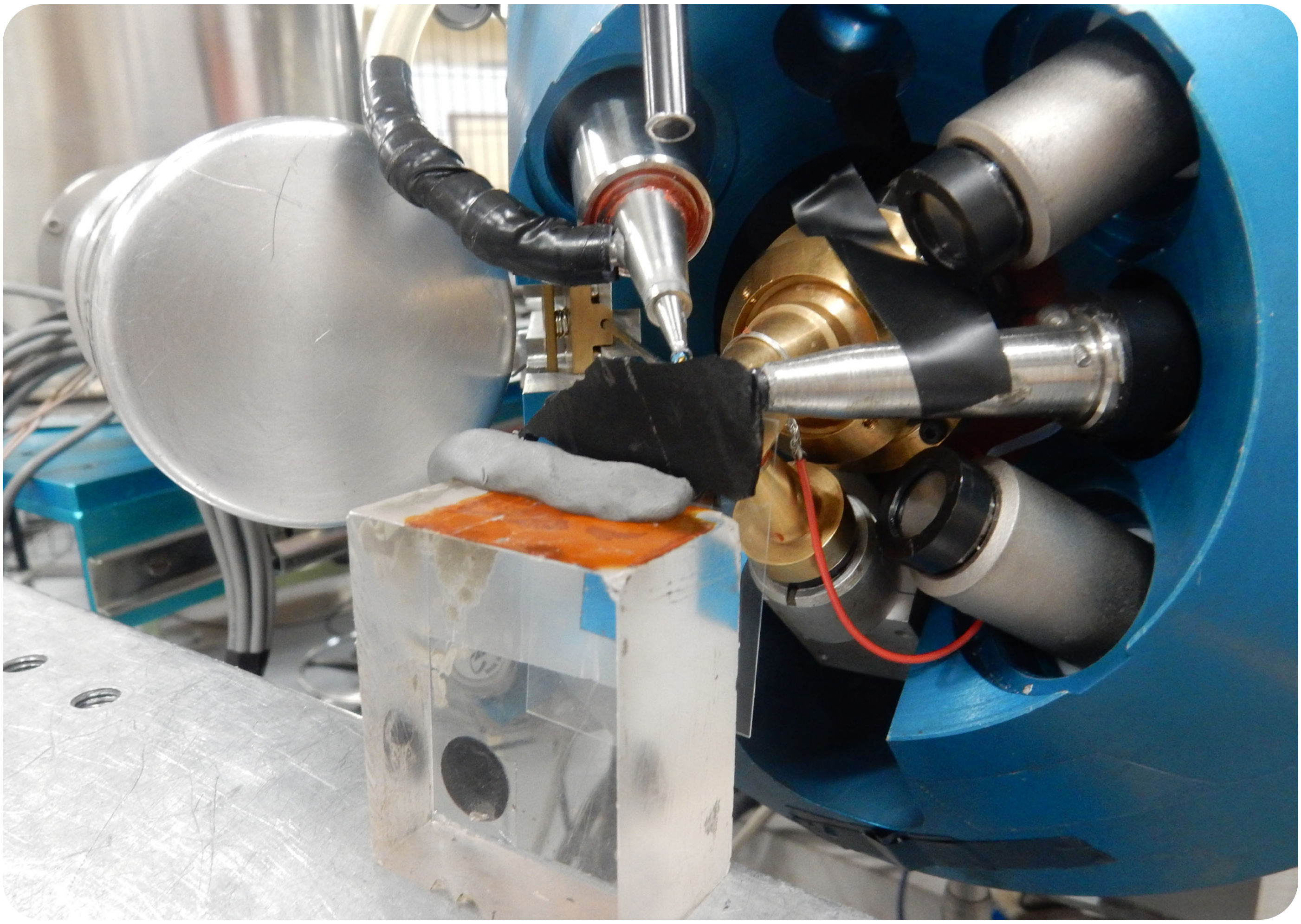
The main culprit for the problem is the jet coming from the Georgian Republic. The collapse of the USSR allowed for the opening of the Sarp Boarder gate from the Georgian Republic into Turkey. The use of this Georgian material is believed to have severely damaged the Turkish indigenous jet industries centred around Oltu in the North-East, working the material known as Oltu taşı or Erzurum Stone. From Turkey, the material is taken west to Asturias and Galicia the seat of the historic Spanish Jet industries where it has also compromised the trade and traditions of local craftsmen. Georgian material has also sadly appeared in Whitby as rough and doubtlessly finished articles. Many of the large amber companies now offer a range of jet jewellery, which is available to buy at trade shows alongside their amber. Although this material isn't initially wholesaled as Whitby Jet, once it enters the retail pipeline there is a high likelihood that this then becomes 'Whitby Jet' due to industry ignorance and the inability to establish appellation of origin. The Venezuelan Jet industry has a quite different but equally damaging threat. Jet has been adopted as a symbol of criminal gangs and dark Cuban religions leading to the jet carvers literally becoming a dying breed.

In an attempt to protect the jet workers of the world a number of us have now come together to work for a common goal to promote artistry and design within the craft and attempt to protect our materials legally and ultimately our jet culture.

So why is this so difficult? Firstly, jet is a hydrocarbon, in the case of Whitby Jet and best quality Asturian Jet almost pure with very little other elemental enrichment. Most traditional gem testing techniques cannot test for elements above sodium on the periodic table, so as jet consists almost entirely of lighter elements testing is problematic. Traditionally therefore, as jet is a solid hydrocarbon, attempts have been made to shoehorn it within the Coal Rank Classification System (a reflectance technique carried out under submersion with a measure of the percentage of light return from a polished surface, used to give an estimation of the calorific value). Jet will test as a lignite however, with a reflectance of 0.2 and hence the universal definition of jet as a lignite. Unfortunately, jet exhibits a phenomenon known as reflectance suppressance meaning that it tests erroneously for coal rank. The carbon content of jet is seen to be 50% higher than most lignites and the high volatile organic compound concentrations in jet also suggest a much higher rank fuel grade coal, putting jet within a subbituminous class. Jet also has a much lower ash content than most fuel grade coals, hence the ability to burn almost completely. It also shows an anomalous enrichment of hydrogen meaning it can be described as a perhydrous coal. In the case of the Jurassic Whitby and Asturian Jet this hydrogen enrichment is a result of impregnation by migrating hydrocarbons during early diagenesis. Although coal petrology gives us a basic understanding of the nature of jet, it gives us only limited help for the appellation of origin.

In order to establish this we do of course need a unique spectrum or range of values, for each jet within the jet group. As mentioned previously, the archaeological community has established an average spectrum for Whitby Jet using FTIR. This however is nonsense. In Whitby alone we have at least four basic types of jet: hard, soft, brittle and cored. There is almost certainly an infinite range of geochemistry between these end members. As jet isn't crystalline as other polymorphic minerals are, the geochemistry is able to show wild differences. Jet is a polymer and as such many different trace elements can be incorporated within the polymer chains.

In June last year the first detailed analysis of jet was carried out at the Centre for Research and Restoration of Museums of France, located beneath The Louvre in Paris. Funding



Particle-induced Gamma and X-ray emission spectroscopy testing on Whitby Jet (Photo by Sarah Steele)

Asturian Jet Master Craftsman María Perez (Photo by Sarah Steele)


The work of Victorian Whitby Jet Carvers (Photo by Sarah Steele)


Whitby Jet showing fossilized bark texture (Photo by Sarah Steele)

secured by the National Museums of Scotland allowed a comprehensive suite of jet materials to be tested using multiple techniques including Particle-induced X-ray emission (PIXE) and Particle-induced gamma-ray emission (PIGE). The National Museums of Scotland is primarily concerned with the identification of their Bronze Age jet-like artefacts and asked me to join the research team in order to secure scientifically collected jet samples and bring my expertise in the raw material. The results of the testing will be published soon but have given us the first true insight into jet as a material.

This jet work is in it's infancy but by working with the jet working communities around the world, new discoveries are coming to light almost daily. I believe that ultimately we will have a definite test for appellation of origin for the jet group which will not only reassure the consumer that their purchase is genuine but also protect the culture of jet working which dates back to the beginnings of civilisation.

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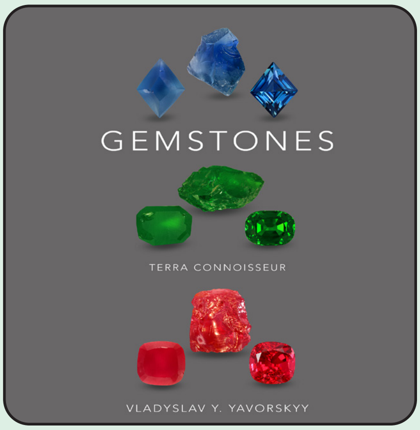
http://www.iperionch.eu/iperion-vision

Literary Speaking

Expand your Mind

In this issue we look at two new publications; Gemstones by Vladyslav Y. Yavorskyy and Suomen Korukivet (Gemstones of Finland) by Kinnunen, Vartiainen, Hietala, Lahti, Lehtonen, Heikkilä, Valkama and Huhta



The author of the groundbreaking Terra Spinel in 2010 and Terra Garnet in 2014 is ready for a new statement on the world of Gems and Art.

Terra Connoisseur is a sensational experience – celebrating the most beautiful, durable and valuable natural creations on the planet.

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With a number of credited names of leading photographers, writers and other gem lovers, Terra Connoisseur comes as an unprecedented collaboration in sharing a common passion for beautiful, faceted, untreated stones, worshipping their nature and encouraging others to appreciate gems.

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Hardcover with Dust Jacket

Total Number of Pages: 234 pages
Dimensions: 240 x 260 mm (9.5 x 10.25 inches)
Production: Full Color

Price: US $88
Shipping & Handling: US$29 (FedEx from Hong Kong)

For more information visit www.gemstonesbook.com

Reviewed by Visoot Pui

BERYL

Beryl refers to all members of the *precious beryl group* that are not emerald or aquamarine. The origin of the name (from the Greek *beryllos*) is uncertain although we do know that the German word *Brille* is derived from it as the earliest eyeglasses were made from colorless Beryl. Some of the color varieties, however, have their own trade names. Golden beryl, or *Heliodor*, is the yellow, lemon/golden-yellow to greenish-yellow variety colored by iron. It is mined in Brazil, Madagascar, Namibia, Nigeria, Sri Lanka and Zimbabwe. It has excellent clarity a vitreous luster and it is found in large crystals. The color is evocative of golden days on golden beaches, of pistachio and vanilla ice cream and a cool breeze caressing one's skin.

8.28 cts

36.80 cts

4.55 cts

9.69 cts

Ukraine was major source of Heliodor, beryl

Kiev, Ukraine

Giant Heliodor crystal from Ukraine

35.29 cts / 2 pcs

42.87 cts

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GEMSTONES

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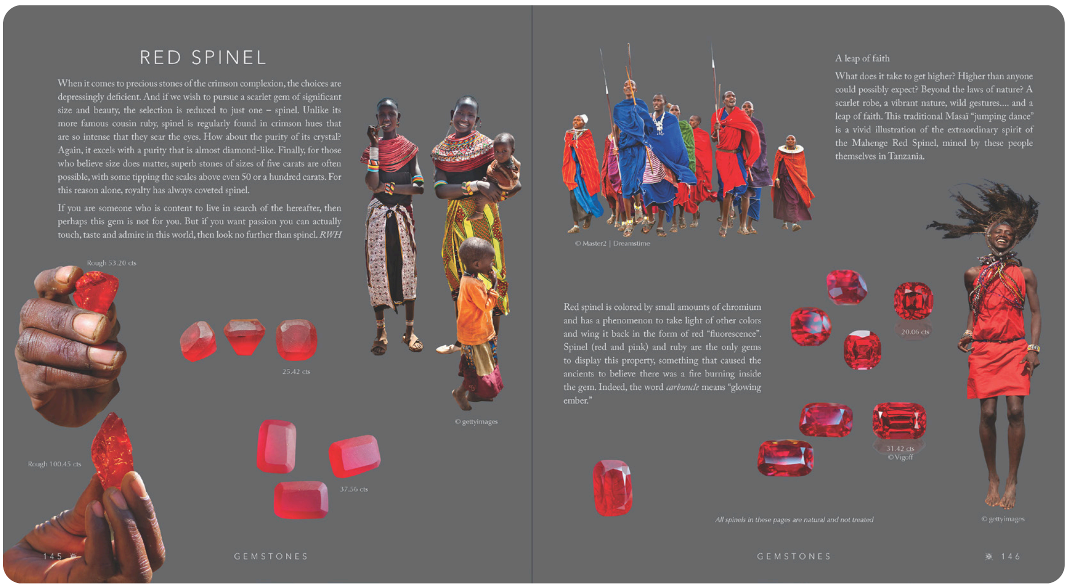

RED SPINEL

When it comes to precious stones of the crimson complexion, the choices are depressingly deficient. And if we wish to pursue a scarlet gem of significant size and beauty, the selection is reduced to just one – spinel. Unlike its more famous cousin ruby, spinel is regularly found in crimson hues that are so intense that they sear the eyes. How about the purity of its crystal? Again, it excels with a purity that is almost diamond-like. Finally, for those who believe size does matter, superb stones of sizes of five carats are often possible, with some tipping the scales above even 50 or a hundred carats. For this reason alone, royalty has always coveted spinel.

If you are someone who is content to live in search of the hereafter, then perhaps this gem is not for you. But if you want passion you can actually touch, taste and admire in this world, then look no further than spinel. *RWH*

Rough 53.20 cts

25.42 cts

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Rough 100.45 cts

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145

GEMSTONES

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A leap of faith

What does it take to get higher? Higher than anyone could possibly expect? Beyond the laws of nature? A scarlet robe, a vibrant nature, wild gestures.... and a leap of faith. This traditional Masaï "jumping dance" is a vivid illustration of the extraordinary spirit of the Mahenge Red Spinel, mined by these people themselves in Tanzania.

Red spinel is colored by small amounts of chromium and has a phenomenon to take light of other colors and wing it back in the form of red "fluorescence". Spinel (red and pink) and ruby are the only gems to display this property, something that caused the ancients to believe there was a fire burning inside the gem. Indeed, the word *carbuncle* means "glowing ember."

20.06 cts

31.42 cts
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All spinels in these pages are natural and not treated

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GEMSTONES

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When Kari Kinnunen asked me if I would include a review of Suomen Korukivet - Gemstones of Finland in the next issue of Gemmology Today I jumped at the chance. I have always had a soft spot for Finland. I don't know why. I have never been there, do not have any family from there and to be honest know very little about the country but it has always struck me as being a nice place. I am afraid that my general ignorance extended to gems and minerals from Finland although I have always loved Spectrolite. I confessed to Kari that my Finnish was not very good to which he replied 'It's in Finnish and English'. Perfect, I thought and eagerly awaited the digital file.

Having lived in British Columbia, Canada for over 20 years, I was amazed at how many gemstones come from there and yet are seemingly unknown to those in the gem trade. I suspect many will feel the same way about gemstones from Finland. It is perhaps not an obvious place to find them but then again, who would have thought that Canada would have an abundant supply of diamonds?

The book is a collaboration between Kari A. Kinnunen, Risto Vartiainen, Satu Hietala, Seppo I. Lahti, Marja Lehtonen, Pasi Heikkilä ,Jorma Valkama and Pekka Huhta and I can see why. Writing any book is difficult but in this case, the research needed to provide a complete study of Finnish gemstones would have been extremely time consuming and laborious. While collaborating always conjures up images of 'more hands, less work', it is quite the opposite and especially difficult to present a cohesive end product. They have certainly succeeded because Suomen Korukivet really dots all the 'i's' and crosses all the 't's'.

According to the authors 'In Finland, unlike in many other countries, rocks are often used as gemstones instead of minerals. The quality requirements are largely the same for both rocks and minerals when it comes to jewellery. The key aspects are attractiveness, suitability for fashioning, and durability. Finnish bedrock is composed of ancient Precambrian rocks; mostly hard and durable types of rock with many variants suitable for use in the jewellery industry'.

It is also interesting that there are one hundred gemstone deposits throughout Finland and yet only 20% have been exploited on a larger scale.

The first part of the book covers the essentials; the physical properties of gemstones, the nature of light, the cause of colour, optical pehnomena, inclusions and cutting but also delves into the legal aspects of gem prospecting and the bane of my life; trade names.

From there, the book takes a different approach looking at four specific areas of Finland (Southern Finland, Eastern and Central Finland, Western Finland and Northern Finland) in great detail.

While Southern Finland clearly has the lions share of gemstones, I was surprised at the variety of gemstones found throughout Finland including corundum (rubies and blue sapphires), spectrolite, beryl (emerald, yellow beryl and aquamarine), topaz (light brown, red-brown and blue), quartz (amethyst, smoky quartz and rose quartz), labradorite, tourmaline (black, brown and green), apatite (blue and green), garnet (grossular, almandine and uvarovite), iolite, helsinkite, nephrite jade, amber, chrome diopside, diamond, amazonite, thulite, jasper, epidote, rhodonite, unakite, chalcedony and river pearls. Again the similarities between Finland and British Columbia seemed strikingly similar.

Each section also gives a detailed geological overview of each area and it is here that you can see that the authors are all geologists and mineralogists who just happen to love gemstones.

Curiously the gem industry is relatively young in Finland with most references dating back to the early 1950's and while rocks and minerals were used in the 19th Century, the cutting and polishing of gemstones occurred much later.

The photography is also a delight, beautifully taken and very professional. In fact the whole book is a quality production from the text to the images to the layout.

At 342 pages, what is even more remarkable is the price. At just € 40 and with the digital pdf free.

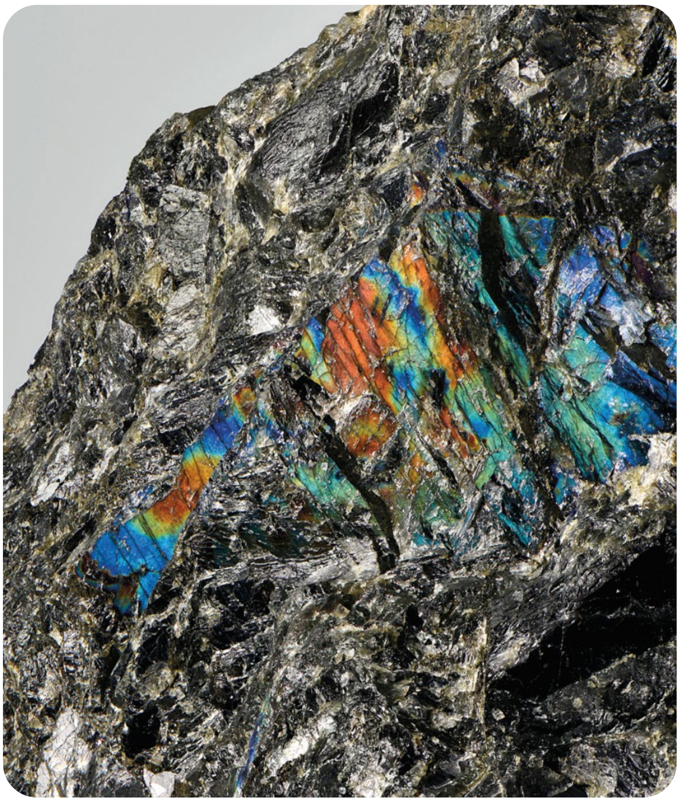
This is certainly a book that needs to be supported not just because it is one of the few 'English' texts regarding gemstones from Finland but because its preparation must truly have been a labour of love.

You can order the book online by clicking here

Now where did I put my snowshoes!

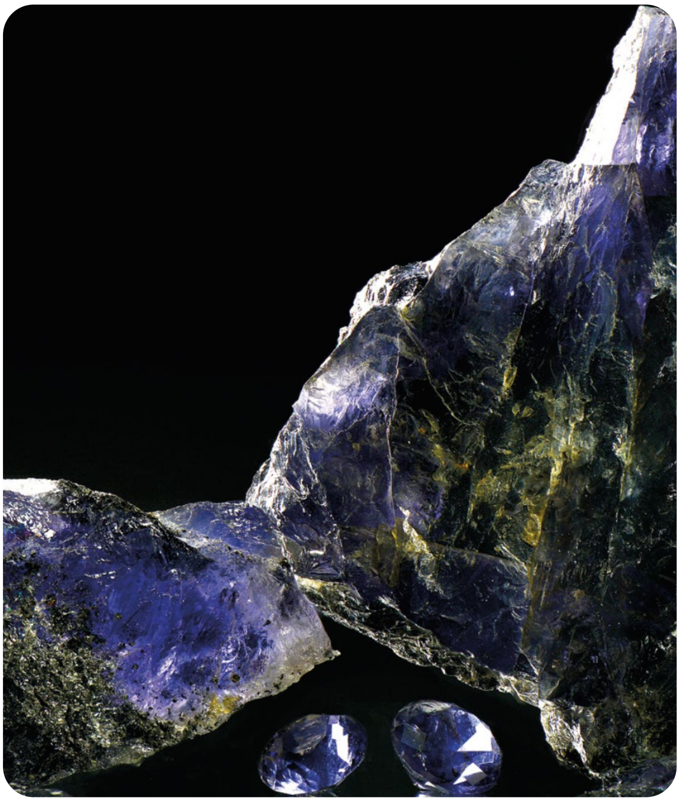
Reviewed by Geoffrey M. Dominy

Luumäki Gem Beryl Crystal

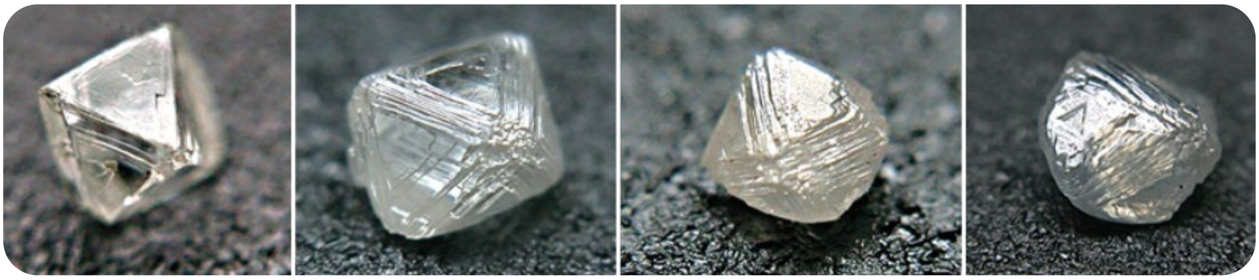


Spectrolite rock from Ylämaa

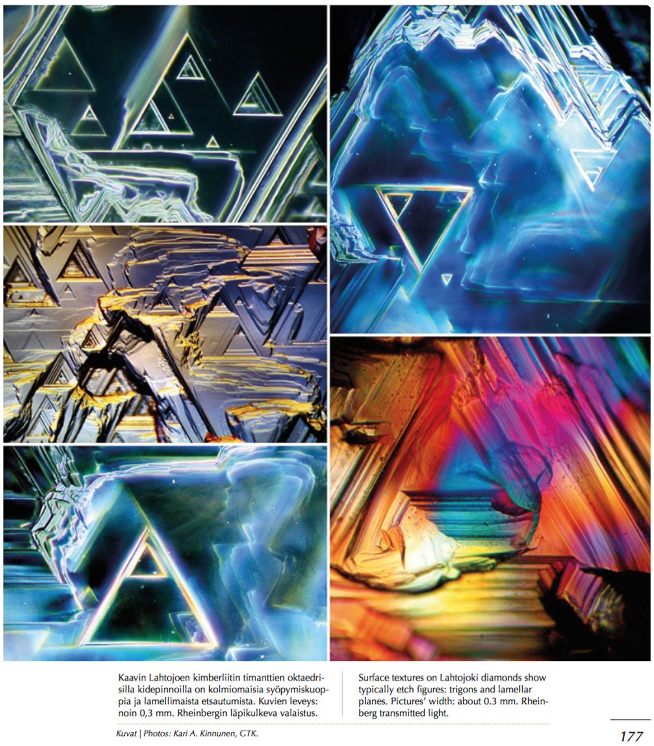
Chrome Diopside from the Outokumpu Mine



Cordierite from Kiuruvesi



Surface textures on Lahtojoki Diamonds



Surface textures on Lahtojoki Diamonds

Gem quality blue sapphire from the Miessijoki mining area

Iridescent Labradorite from Sipoo

Spectrolite and Gold Nugget Jewellery

Meet our team of dedicated professionals who all share a common philosophy, a common goal and a passion and commitment to gemmology and education.

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 third edition, the handbook has been sold or downloaded in forty-seven countries, is used by fourteen schools, colleges, universities and gemmological organizations as their recommended textbook and now features photographic contributions by another award winning photographer Jeff Scovil.

Geoff currently lives in Palma de 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.

James Riley
British Gem Academy

James Riley is a sixth-generation jeweller who studied modern history at university, was the former manager of Backes and Strauss in the U.K and the former Chief Executive Officer of Gem-A.

During his time at Gem-A, James along with other Board members, was instrumental in revitalizing the association, securing Ely Place as their London headquarters and implementing several key initiatives.

He is a well-respected figure in the gemmological community, is passionate about education, gems and jewellery and brings a wealth of experience to the British Gem Academy and the World Gem Foundation.

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
Scandinavian Gem Academy

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 (Säterglántan 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.

Leroy Bakelmun
Pacific Northwest Gem Academy

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.

He currently lives in Grass Valley, California with his wife Sally and family.

Majala Mlagui
Kenyan Gem Academy

Ms Majala Mlagui is a mining entrepreneur and African gemstone lover.

Majala founded her social enterprise Thamani Gems, to empower such miners in East Africa by helping them create sustainable livelihoods through responsible mining, ethical sourcing and access to fair-trade markets.

Majala also provides professional-development resources to miners and helps them navigate complex regulatory and legal systems in their country. Her work raises the profile of local miners in Africa and improves their economic conditions.

Majala received her BEng in Software Engineering from University of Sheffield in England and is a certified PRINCE 2 Project Manager. She has taken the Exploring Gemstones Certificate from Holts Academy, London (UK) and is a Gemological Institute of America (GIA) Accredited Jewellery Professional (AJP).

Majala is working towards the GIA Coloured Gemstones Programme certification.

Rahul Desai
SRDC WorldGem

Rahul Desai began his career taking forward his father's creation Shreeji Rajendra Diamond Classes (SRDC-INDIA), a pioneer in diamonds, gems and jewellery education throughout India that has graduated more than 50,000 jewellers, gemmologists, diamond traders and jewellery designers through their educational programs.

One of the first and foremost private institutions in gems and jewellery education, SRDC – INDIA received world recognition through its corporate education program in various countries including Turkey, Hong Kong, Bangkok, Myanmar (Burma), Dubai and Bostwana.

Renuka Punjani
SRDC WorldGem

Renuka Punjani has worked within the jewellery industry for nearly 25 years with a tremendous inclination towards designing and fine jewellery and has worked closely with some of the industry leaders, designing personal family fine jewellery.

Cristina Rzepka de Lombas
Spanish, South American, 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 Spanish, South American, Central American and Caribbean Gem Academies.

World Gem Foundation Gem Academies

To contact the individual gem academies, please click here

EGOR GAVRILENKO is the current Director of the Gem Testing and Certification Laboratory of the Spanish Gemological Institute, holds a PhD in Geology and is a qualified and highly respected gemmologist. He is also an avid gem cutter and photomicrography enthusiast.

Rock with a Little Heavy Metal (Part Two)

The second of a three part series that looks at the identification of HPHT and CVD synthetic diamonds. In this issue we look at their reactions and transparency to UV light (including phosphorescence) and their spectroscopic analysis.

Ultraviolet Light Fluorescence and Phosphorescence (HPHT)

Most natural diamonds belong to the so-called 'Cape' series and show a bluish fluorescence of varying intensity, although some may be virtually inert or exhibit other fluorescent colors (yellowish, greenish, etc.). In general, the fluorescence intensity in natural diamonds is greater under long-wave ultraviolet light (365 nm) and less under short-wave ultraviolet light (254 nm), (i.e. UVLW > UVSW). Fluorescence is generally homogeneous, although it may also be associated with certain planes and zones.

In contrast, synthetic diamonds do not exhibit a bluish fluorescence. Instead, they are either inert or exhibit weak yellowish, greenish or orange fluorescence. It is very important to note that the intensity of the fluorescence in synthetic diamonds is generally stronger under short-wave than it is under long-wave (UVLW < UVSW). In addition, the internal growth sectors of fancy-colored HPHT synthetic diamonds often produce a cross-shaped fluorescent pattern or similar geometry (Fig. 6). In some synthetics, UV fluorescence to long and short-wave may be similar (UVLW ≈ UVSW), contrary to marked difference usually observed in natural diamonds (UVLW > UVSW).

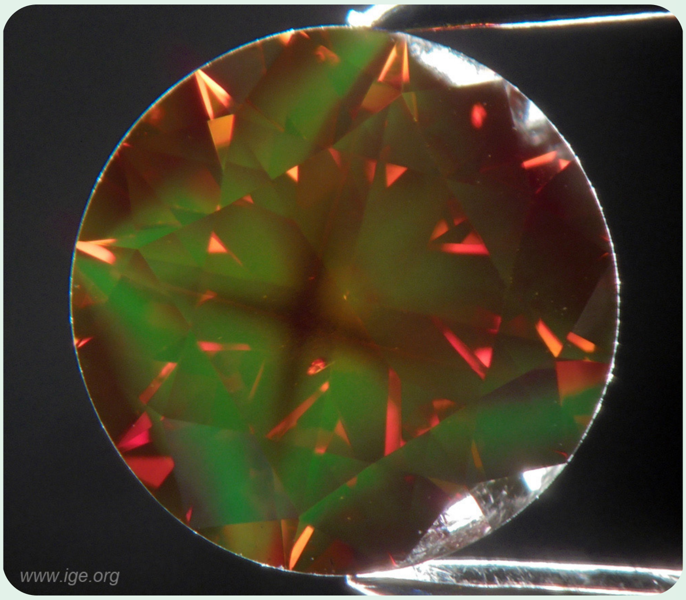


Fig. 1: Greenish fluorescence in the shape of a cross observed in incandescent light on a synthetic HPHT brown diamond (Analyzed in the IGE Laboratory).

Another very important feature of synthetic colorless HPHT diamonds is the presence of marked phosphorescence (afterglow) seen when the short-wave UV radiations have been turned off. In natural diamonds, this is rare with weak phosphorescence only usually evident in stones that exhibit very strong fluorescence to long-wave UV light and to a lesser extent under short-wave UV light.

To observe this phenomenon, it is recommended that the diamond be viewed in a darkened room that allows the observer to detect even low levels of phosphorescence.

The observation of fluorescence and/or phosphorescence is a simple but very effective method for the detection of HPHT synthetic diamonds, especially in situations where other methods may not be applicable, such as when testing diamond melee or stones set into jewellery.

Observation of phosphorescence in diamonds has a great potential for development of portable and relatively inexpensive devices for quick detection of synthetic diamonds even in melee sizes and mounted in jewelry. Some devices already available on the market include:

- PhosView™ De Beers
- ALROSA Diamond Inspector *
- OGI DiaTrue

Transparency to Short-wave UV Light (HPHT)

The vast majority of natural diamonds (98%) belong to Type I, which contain nitrogen in their composition, either as aggregates (Type Ia) or as dispersed atoms (Type Ib). Type I diamonds are opaque to short-wave UV light. Colorless synthetic diamonds, both HPHT and CVD, belong to Type

IIa, which is very rare in natural diamonds. In addition, natural type IIa diamonds are susceptible to high pressure and high temperature treatment (HPHT treatment) to improve their color. Type II diamonds are transparent to short-wave UV light. Therefore, observing short-wave UV light transparency has become a fast and reliable method for distinguishing colorless Type I (natural) and Type II (treated naturals or synthetic) diamonds.

Different methods can be used to study the transparency of a gem to short-wave UV light. The Swiss Gemological Institute (SSEF) has developed a very simple piece of equipment that serves this purpose called the 'SSEF Diamond Spotter™' (Fig. 2). It consists of a white screen that has been covered with a powder that will glow green when illuminated by short-wave UV light.

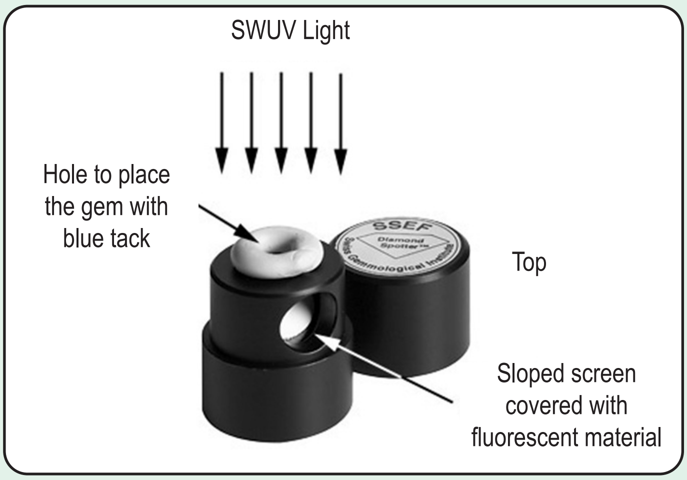


Fig. 2: SSEF Diamond Spotter™ (Courtesy of SSEF)

To test a diamond, place it in sideways so that the short-wave UV light enters the diamond from a pavilion mains and exits the diamond from an opposite crown facets. To ensure that the short-wave UV is directed into the diamond and does not reach the white screen directly, use blue tack.

Two results are possible; if no green spots are observed and the screen remains white, the diamond has absorbed the short-wave UV light and is therefore type I (natural as opposed to HPHT treated for color enhancement). If green spots are visible, the diamond is transparent to short-wave UV light and it belongs to type II (meaning that it can be synthetic or HPHT treated). In this case, further tests will be needed to determine the nature of the diamond.

This test must be performed in a darkened room with safety goggles.

It should be noted that a very rare type of diamond in nature, the pure type IaB, which represents only 0.2% of the total natural diamonds, is also transparent to short-wave UV light therefore it is essential that all diamonds showing transparency to short-wave UV light are further tested to ensure their actual origin (natural or synthetic) and whether they have been HPHT treated.

In addition to the SSEF Diamond Spotter ™ there are a number of other devices that incorporate the same principle including HRD's D-Screen, DiaGuard ™ by M & A Gemmological Instruments, Presidium's Synthetic Diamond Screener, Gemlogis Taupe Diamond Segregator and Smartpro Screen-I. The Presidium Synthetic Diamond Screener and the Smartpro Screen-I can also be used to test mounted diamonds provided the settings permit the passage of light.

Optic Absorption Spectra (HPHT)

Optic absorption spectra of most colorless natural diamonds differ from their synthetic counterparts. The most common spectral characteristics of natural diamonds are the 'Cape series' lines, with the main line at 415 nm and additional lines at 452, 465 and 478 nm. The presence of the 415 nm line in a colorless diamond, which can be observed in the majority of natural diamonds even with a hand-held spectroscope, can be considered proof that it is natural.

De Beers DiamondSure uses the 415 nm line to detect Type Ia diamonds, and separate them from colorless HPHT and CVD synthetics and natural diamonds that could have been treated by HPHT. This device can handle both loose and mounted stones (larger than 0.04ct approximately), providing a quick and simple screening method that either confirms natural origin or indicates stones that should be further tested.

Ultraviolet Light Fluorescence and Phosphorescence (CVD)

The behavior of CVD synthetic diamonds under UV light is similar to that of synthetic HPHT diamonds described above, and totally atypical for natural diamonds. CVD synthetic diamonds do not exhibit blue fluorescence but will typically display greenish, yellowish or orangey fluorescence that is stronger under short-wave UV light (UVLW < UVSW), and with phosphorescence in some cases, although not as marked and common as in synthetic HPHT diamonds.

Transparency to Short-wave UV light (CVD)

Like synthetic HPHT diamonds, colorless CVD synthetic diamonds are also Type IIa diamonds, contain virtually no nitrogen and are therefore transparent to short-wave UV light.

Fortunately the vast majorities of natural diamonds are Type Ia and are opaque to short-wave UV light, so they can be easily identified as natural by this method. However, it should be remembered that there are also natural Type IIa diamonds, in addition to the very rare Type IaB mentioned above, which also exhibit transparency to short-wave UV light. Therefore if a diamond exhibits transparency to short-wave UV light, this does not necessarily mean that it is synthetic. Further tests should be used to confirm its identity and origin.

Optic Absorption Spectra (CVD)

As with HPHT synthetic diamonds, the hand-held spectroscope can be used to differentiate between natural diamonds and CVD synthetic diamonds with natural diamonds exhibiting the 415 nm absorption line ('Cape' series). This is especially evident in diamonds of a lower color. This provides a rapid screening method to separate natural diamonds from possible synthetics of both types and natural diamonds that have been treated by HPHT.

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* According to the manufacturer, the ALROSA Diamond Inspector is based on three different analytical methods.

ANTOINETTE MATLINS, PG, FGA, is
an internationally renowned gemologist and is the author of the best selling books Jewelry & Gems: The Buying Guide; Gem Identification Made Easy; Diamonds; Colored Gemstones and many other books about buying and enjoying jewelry and gems.

Red Emerald or Red Beryl..What's In a Gemstone's Name? Time To Reflect and Rethink

Where colored gemstones* are concerned, there is often more than a single name by which a specific gemstone is known. Generally speaking, there can be a mineralogical name and a popular name. The mineralogical name is the scientific name for a gemstone - its 'family name' so to speak - and the name is usually designated by an internationally respected geological/mineralogical organization. The popular name is the name by which many gems are best known to the general public, and often make no reference to the mineralogical name of the material at all.

Some of the best-known mineralogical names for gemstone families include beryl, chrysoberyl, corundum, garnet, quartz and topaz. Some minerals, such as garnet, also have mineralogical sub-categories when there's more than one gemstone within the designation. For example, the name spessartine (spessartite) is designated for an orange variety of garnet, andradite for a very highly dispersive yellowish-green color, and heliodor for a yellow variety.

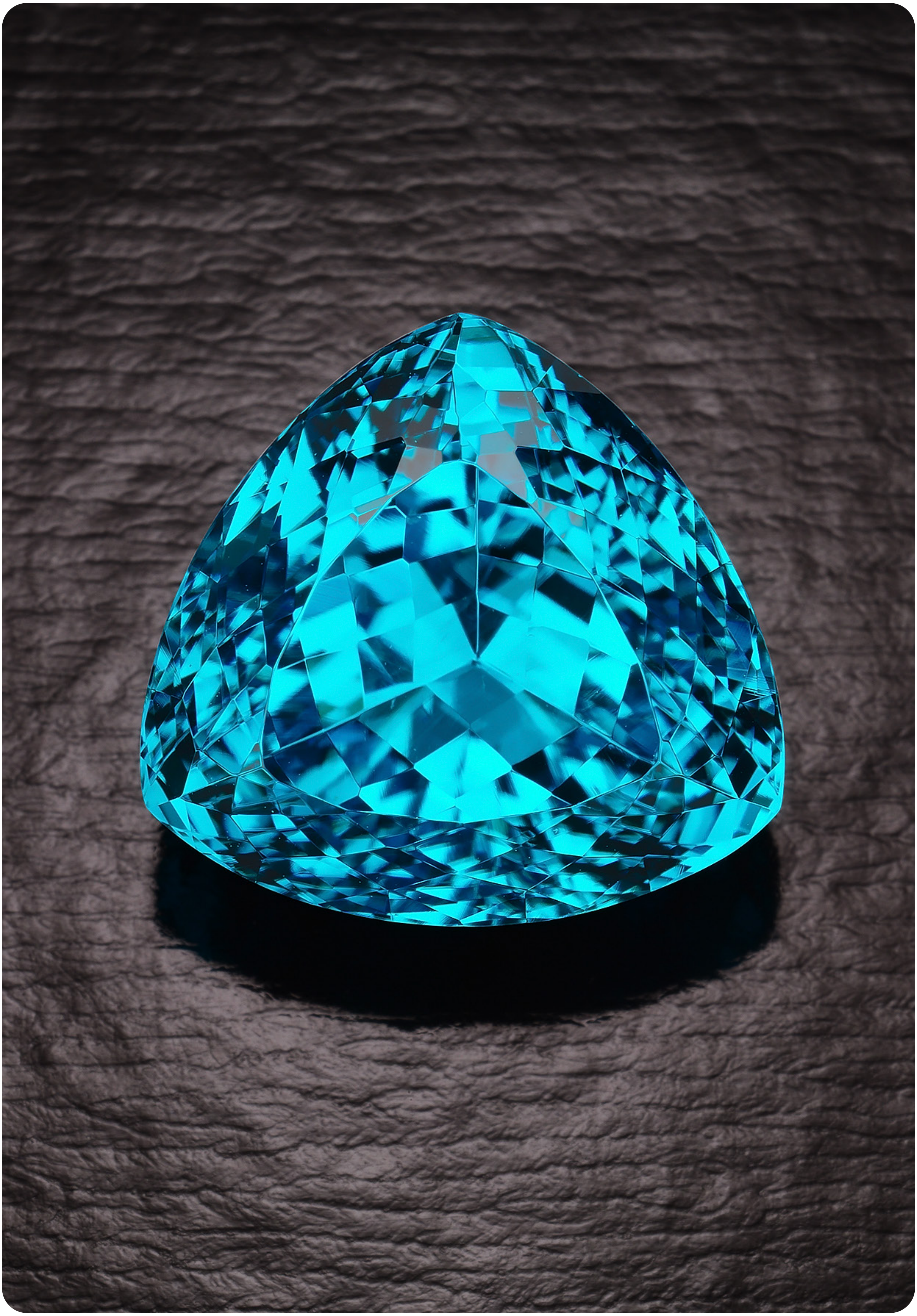
For both trade and public alike, however, the names can get confusing and sometimes fail altogether to communicate, to the public what the gem actually is, and this needs to be corrected where the public is concerned. For example, many people know the gemstone commonly called by its popular name, amethyst, but if you ask the same people who love amethyst if they like purple quartz, most would admit they have no idea what it is, and ask, 'what's quartz!' This is not really surprising if you stop to think how rarely anyone ever sees the mineral 'quartz' associated with the name 'amethyst'. Similarly, many people can describe an aquamarine and tell you interesting tidbits about it, but if you were to ask them to name the medium-deep-blue variety of beryl they'll tell you they have no idea what it is; most have never heard of 'beryl'!

Mineralogical and popular names alike often have origins associated with color, or a certain physical characteristic, or a place, or even the name of a person. Perhaps even more important, in many cases they carry an association to value. The latter, perhaps more than any other, is why gemstone names matter to most people. In cases where both the mineralogical and popular names are the same, there are no issues. However, this is not always the case, and often it is the popular name that more immediately communicates to the public exactly what the gemstone is. There are no clear rules however whatever the name, it is important, where the consumer and general public are concerned, that the name communicates not only in terms of identity but most importantly how it compares in terms of value among other members of its own mineral family and within the broader gem and mineral world.

Let's take a moment to examine a mineral group that's well known today to the public: the tourmaline group. Most people know what tourmaline is because it's been sold for many decades by its mineral name, tourmaline. In addition, most people who love gems and jewelry know that tourmaline comes in many colors because it is sold as: green tourmaline (or for a rarer green variety, chrome-tourmaline), pink tourmaline, yellow tourmaline, black tourmaline, blue tourmaline, cuprian or 'Paraíba' tourmaline, and so on. What becomes clear is that the mineral name, tourmaline, is usually present, as is the color.

In addition, where tourmaline is concerned, there are also several members known by names that rarely make any association to the mineralogical name. These include the red variety, which is usually called simply rubellite, and a deep blue variety often called simply indicolite (the name making reference to the color indigo). If we explore the history of rubellite, you can begin to comprehend other factors affecting 'what's in a name'. One will never see 'rubellite' sold simply as 'red tourmaline' even if this is more accurate, mineralogically speaking. This is not just because the name itself has been known and accepted for so long, but perhaps more importantly, the name itself, by calling to mind the well-established and well-known gem 'ruby', three factors are immediately communicated: (1) a red color; (2) rarity; (3) a higher value among the tourmaline family.

* For purposes of this discussion, we are not including fancy-color diamonds since they are in an entirely different category in terms of public recognition and valuation.



Paraíba Tourmaline (Photo by Tino Hammid)

Now the question one should be asking is whether or not a different name might be merited and appropriate. In the case of rubellite, I do not know anyone who would argue that the answer is YES!

There are three reasons why the name rubellite is accepted within the trade: (1) like ruby, it has a red color; (2) like ruby, it is one of the rarest colors of its mineral family (in this case, tourmaline); and (3) like ruby, demand continues to increase while supply continues to decrease, resulting in higher value that people have demonstrated they are willing to pay. So rubellite has been an accepted 'trade name' for many decades.

In addition to using the name rubellite alone, however, today we are seeing it sold more often as rubellite tourmaline, combining its historical and mineral names, which makes it very clear to the public exactly what the material is.

Where other mineralogical sub-categories for tourmaline are concerned – such as dravite for brown tourmaline or verdelite for the common green variety of tourmaline - since they have never been promoted to the public and as a result have no meaning to the public and communicate nothing to the typical consumer; primarily geologists, mineralogists and gemologists are the only people who know what dravite and verdelite are. The reality is that very few people outside of the sciences connected to the gem world are familiar with mineralogical names.

Thus, in the case of most tourmalines, using the mineralogical name, qualified by the color, communicates exactly what people need to understand in order to know what gemstone they are buying in terms of what the material is and the relative value of one color versus another within the tourmaline group. And in addition, as is the case of some varieties such as rubellite, combining its 'popular name' - rubellite - with the mineralogical name does the same thing: rubellite tourmaline says to the public: this is a red stone belonging to the tourmaline family, which is a rare variety and has a value higher than any other member…that is until the late 1900s when a recently discovered, new variety of tourmaline was discovered in Paraíba, Brazil.

It quickly became know as 'Paraíba' tourmaline, an exceptionally beautiful, extremely rare, copper-bearing variety of tourmaline, for which demand was immediate and began escalating at unprecedented levels. It now sells for more than many sapphires…and rubies…despite its being just a tourmaline! It wasn't long before the public became as excited by PARAÍBA TOURMALINE as they were by sapphire and ruby, and in some cases, even more excited!

Then other problems developed with the name 'Paraíba' tourmaline when copper-bearing tourmaline was discovered in other countries, so it was no longer unique to Brazil. People began to question the use of the place name, 'Paraíba', for material that did not come from Paraíba, since the trade does not permit rubies or sapphire to be sold as 'Burmese' or 'Ceylonese' or any other 'place' unless they come from that place. So how can copper-bearing tourmaline from Nigeria be called, and sold, as 'Paraíba' tourmaline? This debate continues as I write this, but there is growing recognition that just as Burma and Ceylon rubies and sapphires have characteristics unique to those countries, so do the copper-bearing tourmalines from Paraíba, Brazil so I predict that 'copper-bearing tourmaline' will face ever increasing challenges as a sub-category of the tourmaline family.

More importantly, it is already causing confusion in terms of the public and consumers, who already associate certain colors - and prices - with 'Paraíba tourmaline' that is often not merited by material from other locations. This is already resulting in exploitation of the public, but to complicate the issue even further, the same people who become so excited about 'Paraíba tourmaline' have no idea what 'cuprian' tourmaline is, nor for the most part, any interest in it because it has been so heavily promoted as 'Paraíba tourmaline'!

This is an example of various issues associated with the names of gemstones. Some materials pose even greater challenges in terms of what the name itself communicates to the public about a stone's identity, rarity and value.

Unfortunately, identifying a gem by its mineral name, or its mineral name combined with its color, or even its mineral name combined with a popular name will accurately communicate important information that the public needs to know, and it is getting more and more complicated with each passing decade, and is predicted to become even more complicated.

Today there is a much wider range of gemstones available than ever before because new technologies have resulted in the discovery not only of new sources of known gems, but also new gemstones altogether, and new colors of known gems that have never been seen before. All of this is creating new challenges in terms of what to call them to ensure they are properly identified to the public.

Gemstone names need to communicate quickly not only what the gemstone is but also how it compares - in terms of rarity and value - by comparison to other members of its particular gemstone family and within the broader world of gemstones altogether. This is no small challenge in today's world of instantaneous mass communication through the media and Internet.

Two new gemstone varieties were discovered in the 1960s, and two new gemstone names immediately entered our vocabulary. Both were named in recognition of where they were discovered, and neither name contains any reference to the mineral family to which it belongs. They were totally new to the gem and jewelry world, with names never before heard in the industry, but they were immediately embraced

Emerald Crystal (Colombia) (Photo by Jeff Scovil)

Red Beryl (Utah, U.S.A) (Photo by Jeff Scovil)

Bixbite or Red Beryl (Photo by Tino Hammid) by both the jewelry trade and the public. The first was a fabulous blue variety of the mineral zoisite that was discovered in Tanzania and was named tanzanite. The second was an emerald-green variety of the mineral garnet, a color never before seen among the varieties of garnet, which was found in the Tsavo National Park in Kenya, hence the name tsavorite!

Now let's take a closer look at these two gemstones for a moment. They both rose to fame quickly because visibility and dissemination of information occurs much faster today; in today's world, new gemstones are seen not only in jewelry stores but also on television shopping channels, on the Internet, in the fashion sections of magazines and newspapers and on fashion runways…the latter all picked up by the various traditional media sources too! As a result of such wide exposure, it doesn't take as long as it once did for the public to gain an understanding that these gems exist, and what they are. And perhaps most importantly, it doesn't take long for the public to know how they compare in cost to other gemstones of similar color.

Gaining such visibility, however, is far more likely to happen with gemstones that can be mined in sufficient quantity to assure a steady supply, as was the case with tanzanite and also for tsavorite. Exceptionally rare gems, however, aren't being mined in large enough quantities to be able to provide what is needed to gain widespread media attention on TV shopping networks, the Internet, in newspapers and magazines or on the fashion runway. It is very unfortunate, not only with regard to the attention these very rare gems merit, but also the failure to make the public aware of these gems increases the potential for fraud and misrepresentation.

The gem and jewelry industry must do more to better communicate to the public about these rare gems to reduce the potential for fraud and misrepresentation, and in today's world, the best way to do this is by examining more broadly the implication of the names now used. Today, more than ever before, it has become essential that the name itself quickly and accurately communicate: (1) what the material is; (2) how rare the material is; and (3) where the material stands in terms of relative value within the broader world of gemstones. No gem illustrates this better than the mineral we call beryl, and, in particular, the challenges faced by its red variety, one of the rarest of all gemstones.

Few people are familiar with the mineral beryl, nor know that some of today's favorite gemstones are members of the beryl family. Very few people outside the gem and jewelry world have ever heard of beryl. So while many people know immediately what aquamarine is and have an idea of its relative values within the larger gemstone world, if you were to ask them if they like blue beryl, most would have no idea you're referring to aquamarine and would tell you they've never heard of if, and ask what it is!

Similarly, mention green beryl and few people have any idea what it is, but if you mention 'emerald', there is immediate recognition and an immediate association with a very high value. Yet in the beryl family, there are two sub-categories of green beryl, one of which contains a significant percentage of iron that creates a very different color than what is seen in emerald, and which costs much less than the 'other green beryl' we know as emerald!

An examination of this gemstone family underscores the complexities associated with what a gemstone is called. People have known about aquamarine and emerald for centuries and, as a result, have come to associate a relative 'value', generally speaking, to each; they know, for example, that aquamarine is not an inexpensive gem, but that it is much less costly than an emerald of comparable quality. But they do not know these gemstones are both members of the 'beryl' family, nor do they realize how many other gemstones there are in the beryl family, known also by names not associated with beryl.

This lack of knowledge can have very unfortunate consequences for an unknowing public, as we've recently seen in the Caribbean, online, and aboard cruise ships with the selling of common yellow beryl as yellow emerald (sometimes under the name 'Emeryl') at prices much higher than the prices at which it is sold by reputable jewelers and gemstone dealers selling it by its correct name. We've also seen unscrupulous sellers misrepresenting pink beryl (morganite) as pink emerald at highly inflated prices by comparison to what reputable sellers ask for the same material.

This should not really be surprising given how many gemstone names aren't mineralogical names. Many of the names we now use have evolved throughout history and have been accepted for centuries, and for the public these are their names. So for the public, many gem names have no connection to their mineralogical names. The mineral beryl serves as a perfect example. It is one of the most important of all the mineralogical families and yet the mineralogical name 'beryl' is one of the least familiar to the public and rarely used or associated with the wonderful varieties of this gemstone.

Popular names for the best known members of the beryl family include:

- **Morganite** – a pink beryl known as 'morganite' for almost a century, named in honor of the famous 20th century American financier, JP Morgan
- **Aquamarine** – a blue variety known as 'aquamarine' because its color often resembles the slightly greenish-blue color of the sea
- **Emerald** – the rare variety known as 'emerald', gets its lovely green color from trace elements of chromium and/or vanadium, and has always been considered the rarest and most costly member of the beryl family…

And now we have red beryl another 'new gemstone' (relatively speaking) that was discovered in 1904 in the Wah Wah Mountains of Utah (USA). This locale remains the only known source producing any significant quantity of gem-quality red beryl. But despite being discovered over a century ago, it was so rare that it was known only by a small group of mineralogists, who named it 'Bixbite' in honor of Maynard Bixby, the man who discovered it. At the time, the name didn't really matter much, because it was too scarce to market to the public.

But a few decades ago, a much larger deposit was found in the area, leading to a far greater supply than ever before, which lead to its debut in the gem and jewelry marketplace. It was greeted by collectors and connoisseurs with great excitement because the red variety of beryl is the rarest and most highly prized member of the beryl family, one of the rarest costliest gemstones in today's market, and one of the least known of all gemstones! It should also be noted that not only is the red variety of beryl the rarest member of the beryl family, but it is rarer than all other red gemstones of comparable size in the world (with the exception of red diamonds).

Gemological studies have revealed its color results primarily from trace elements of manganese, but it may also have traces of chromium. Even more important, however, in terms of its character, personality, and rising demand, is the fact that its crystallization is comparable to the crystallization of the emerald variety.

Now the question of 'what's in a name' gets increasingly complex in terms of what to call it; the name must correctly and accurately communicate to the public what it is, which as we've already discussed, means more than simply identifying it as a member of the beryl family. It is important for the name to communicate how the red variety compares to other beryl family members in terms of rarity and value but it is equally important to communicate how it compares to other red gemstones of comparable color, rarity, and desirability. In the case of red beryl, the finest examples have commanded prices comparable to ruby and much greater than emerald. But the dilemma faced is what to call it now that there is a larger supply.

There have been several suggestions over the years, including just changing the names of gemstones in the beryl family to include only their color and mineralogical name, but this is not practical (and let's not forget that in the case of beryl, there are two different green varieties, one much rarer and costlier than the other). Furthermore, names such as 'emerald', 'aquamarine', and 'morganite' are established names that have been known for hundreds of years, and no one wants to change the names by which they are already so well known.

With the emerald variety, in particular, there are several reasons for not calling 'emerald' simply green beryl. As mentioned already, there are two entirely different varieties of 'green' beryl. The variety that has been known historically as emerald, and which is known today as emerald, has a unique green hue that results primarily from trace elements of chromium and/or vanadium, and it's these trace elements that set it apart from other beryls. Furthermore, as already mentioned, there is another green variety of beryl which contains significant amounts of iron which diminishes the vivid, pure green hue associated with what we call 'emerald' and this variety has been sold for many years simply as 'green beryl' and at prices much less than emerald.

Emerald has always been much more highly prized and sought-after than other members of the beryl family and it has also been the most costly because of the desirability of its unique and very desirable color, its overall character and personality, and the belief that it was the rarest member of the beryl family. But now we know this is not the case, and in fact, not only is the red variety rarer but emerald lovers are paying significantly more for this exceptionally rare red gem, from the same gemstone family.

What also becomes clear after examining historical precedents is that there is really only one name that associates the gemstone to its mineralogical family, beryl, and quickly and accurately communicates its rarity as well as its color: red emerald. This is the one name that makes it clear the red variety has comparable rarity - actually, even greater rarity - and comparable, or higher value, as has been demonstrated at recent top tier gem and mineral shows.

But perhaps even more persuasive in terms of the appropriateness of the name, red emerald forms under comparable geological conditions responsible for an almost identical crystallization, which is not the case with other beryl family members. So although the gemstone we've always called emerald has historically been identified exclusively as a green gem, there is no reason now that this new material that is in all other respects comparable to emerald should not be called 'emerald' with the qualifier 'red' – red emerald.

I heartily support this name based on the names we see in other mineral families, and also because it is the most immediate way to accurately communicate to the public what the gemstone is in terms of its rarity and value. And most important of all, this name in no way exploits the association to emerald to suggest a rarity or value that the gem does not merit.

Furthermore, this is not a situation in which unscrupulous sellers are exploiting an association to emerald to suggest a rarity and value that other beryls don't have, and I object strenuously to associating any other member of the beryl family, except red, with a name that includes 'emerald'! The red variety, however, is in a class by itself since it is even rarer than emerald, and knowledgeable people are already paying significantly more for the red variety than they are for comparable emerald. So again, I think the name 'red emerald' is the most appropriate name, a name that quickly and accurately communicates what it is to the public without having to rely on inexperienced or uneducated sales people to try to explain what it is.

I think not associating it with its true 'sister gem' (emerald), does a disservice to the rarest, and most valuable member of the beryl family. The Wah Wah mountain range in Utah remains the only known source of mining of this variety in gem quality after almost 100 years since being discovered, so it is probably safe to say it will likely become rarer and rarer, especially if demand continues at its present rate.

Additional Facts Supporting The Name Red Emerald For the Red Variety of the Beryl Family

- In addition to the beryl family, there are other gemstone families where names have been used and accepted throughout history, which make no mention of their mineralogical names, but the names are nonetheless accepted and in common usage within the gem and jewelry industry.
- Twenty thousand (20,000) carats of green emerald exist for every single carat of red.
- Multiple etymological histories exist for the word emerald, which can be traced back to both the Sanskrit and Semitic languages as either Green or Lightning respectively, the second referring to a quality of light. The red variety has the same 'quality of light'.
- Easton's Bible Dictionary defines smaragdos, the Greek word for emerald, as 'Live Coal', following the Semitic understanding, which refers to the unique quality of an emerald's light, also supporting the idea of a red emerald.
- In Chinese characters the characters which comprise the word emerald translate to 'Grandma Green', and those which signify red beryl translate to 'Grandma Red'; in the Far East, an association between the green emerald is automatically assigned to the red variety, as well, because there is no linguistic alternative – in Chinese this gemstone has only one name.
- Download PDF from redemerald.com, click here

Classification of Beryl

Beryl can be divided into two distinct groups. Group 1 consists of varieties that are sawed, preformed, cut/polished and often thermally enhanced to improve their color; this group consists of aquamarine, green beryl, heliodor, goshenite, and morganite. In Group 2, processing consists of sawing (oriented by color zoning and type III inclusions), preforming, cutting/polishing, removing any polishing compound from the gemstone's fissures, followed by clarity enhancement using a colorless medium; this group consists of ONLY emerald and red emerald. It is important to note that the inherent body color of emerald and red emerald is not altered by the enhancement although clarity enhancing reduces the visibility of the internal fractures. While ultrasonic cleaners can be used for Group 1, it should not be used for either emerald or red emerald since it can remove the filler and increase the visibility of the fractures.

The Spice of Life
Coloured Gemstones

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What do you mean......Spodumene?

Spodumene is one of those gemstones that is not particularly well known but from a gemmological perspective, too beautiful and aesthetic to ignore.

Spodumene belongs to the mineral group pyroxene and contains two important gem varieties; Kunzite and Hiddenite. The name spodumene is derived from the natural brownish colour of opaque spodumene crystals and owes its name from the Greek word 'spodumenos' meaning 'burnt to ashes'.

Although spodumene can be found in different colours the majority of the gemstones labelled as spodumene are transparent pale yellow to golden yellow. The brownish and colourless faceted stones are suited more to collectors rather than the trade in general. The brownish minerals are used for industrial purposes due to the lithium.

Spodumene is a lithium aluminium silicate with a hardness of 6.5 to 7 on the Mohs Hardness Scale that typically exhibits high transparency and a vitreous lustre. It can be distinguished by its crystal habit, fracture and perfect cleavage and therefore is considered extremely challenging to cut. Most gemstones are eye-clean, available in large sizes and on rare occasions they exhibit chatoyancy (cat's eye effect).

Deposits of spodumene are found all over the world with the main sources of gem quality material found in Afghanistan, Pakistan, Brazil, Madagascar, Mozambique and the US. Interestingly, spodumene was first discovered in Sweden. Kunzite and Hiddenite are named after George Frederick Kunz and William Earl Hidden.

Although at first sight, spodumene can look similar to quartz, topaz and beryl, its pronounced pleochroism and higher refractive index make its separation fairly standard.

Colour

As mentioned before spodumene can occur in a variety of colours due to the presence of transition elements. Yellow spodumene is coloured by iron impurities, pink spodumene (Kunzite) by manganese and green spodumene (Hiddenite) by chromium. The deepest colours are often found at the tops and bottoms of the crystals.

Unfortunately all spodumene will fade, especially if they are exposed to direct sunlight or heat! The colourless spodumene is sometimes called triphane spodumene but this is used more in the world of healing rather than for gemstones.

Treatments

In general, spodumene is not treated or enhanced but we do know that the brownish and green violet materials may be heated to improve colour. In the case of Kunzite, irradiation will convert the Mn^{4+} to Mn^{3+} creating unstable and radioactive stones that must be handled with extreme care (Petrov 1990) while green in spodumene (Hiddenite) can also be produced by artificial irradiation; however, the induced colour fades when they are exposed to sunlight for a few hours.

Crystal System	Monoclinic, distinctive triangular surface markings are often present.
Refractive Index	1.660-1.681
Birefringence	0.014 - 0.016
Optic Character	Biaxial
Optic Nature	Positive
Cleavage	Can occur in two directions, < 90 degrees
Pleochroism	Pink stones: violet to colourless Green stones: yellowish-green to bluish-green
Spectrum	Spodumene: 505, 437,433nm Hiddenite: 690,686,669,646,620,437,433nm
Fluorescence	May display an orange fluorescence under LWUV
Specific Gravity	3.15 - 3.21

Inclusions

Although spodumene is very clean and transparent, stones may contain growth tubes of mica, etched pits and channels that are found next to three-phase fluid inclusions.

Kunzite

The pink spodumene Kunzite is a relative young gemstone, discovered by George F. Kunz (mineralogist for Tiffany's & Co) in the pegmatites of Pala California in 1902. Until the 1990's it was only used as a 'collector's gemstone' however nowadays it is gaining in popularity. Due to the extensive deposits, kunzite is still very affordable compared to other gemstones. The Smithsonian Institution currently has a faceted heart-shaped kunzite of 880 carats in their possession!

The colours of Kunzite range from a delicate pastel pink to an intense violet purple. Due to its tendency to fade when exposed to strong sunlight, Kunzite is often referred to as an 'Evening Gemstone'. Value wise, the deeper the pink, the more valuable it is. Kunzite can be irradiated and then heat-treated to enhance its colour.

Hiddenite

The green variety of spodumene (Hiddenite) was first found by William Earl Hidden, in 1879, in North Carolina. In honour of the gemstone, the town was subsequently renamed 'Hiddenite'. Recent discoveries of green spodumene have been found in Afghanistan and Brazil and as a consequence, the trade refers to all green spodumene as Hiddenite, which is still an issue within the industry. The natural Hiddenite from North Carolina is very rare and can be expensive! So be aware of the irradiated green spodumene! Hiddenite can also fade upon longer exposure to bright light and sunlight. Generally hiddenite is not treated or enhanced but if you encounter a deep 'emerald green' colour, irradiation should be suspected.

Conclusion

Although obviously we must be aware of the cleavage, the propensity to fade and the possible irradiation of green spodumene, Kunzite and Hiddenite represent wonderful, interesting and affordable alternatives to progressively minded jewellers, gemstone connoisseurs and jewellery lovers.

References

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Photographers Note:

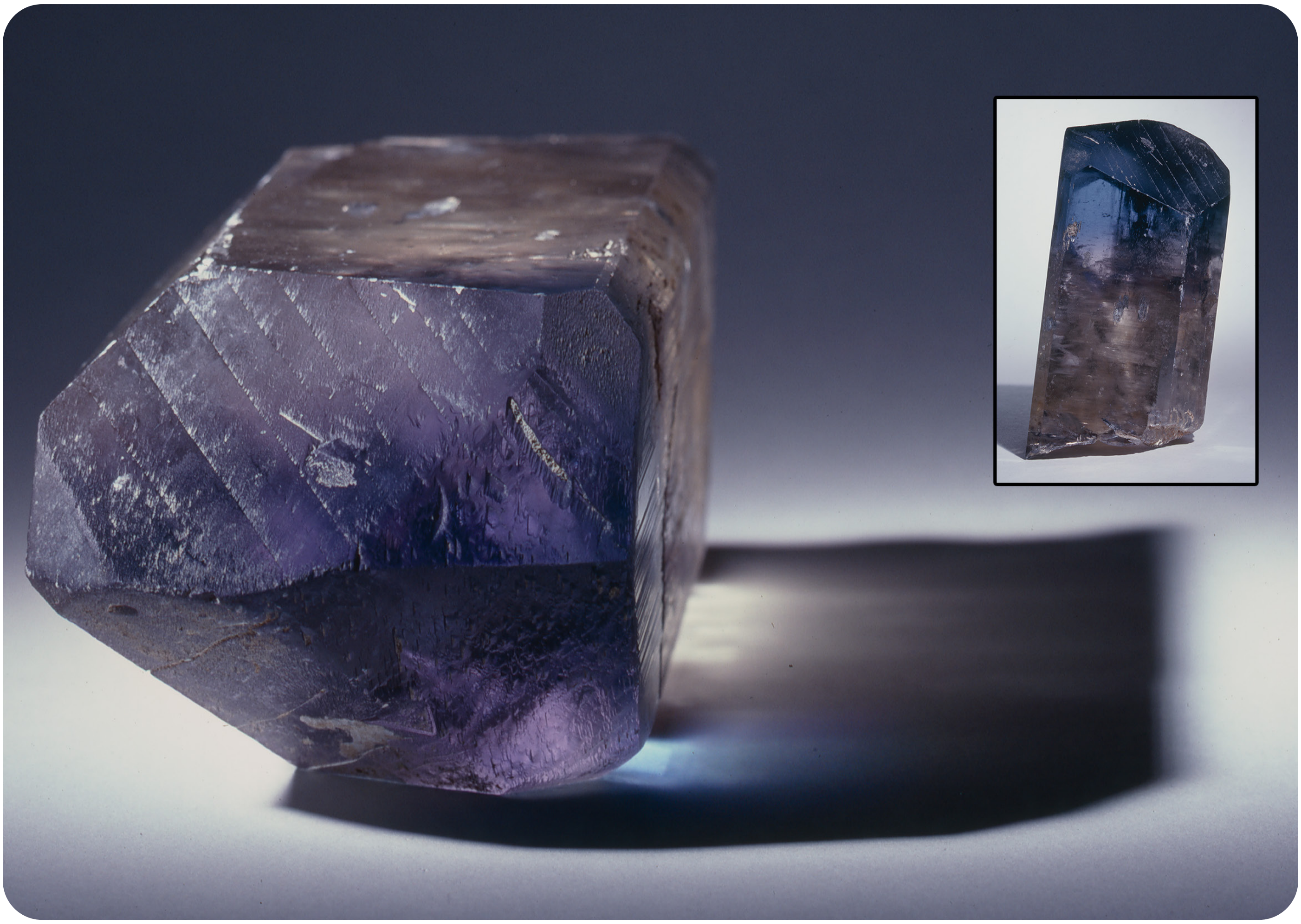
To illustrate the pleochroism in the irradiated spodumene, the stone was photographed using a polarizing filter. For the centre image, the filter was rotated 90 degrees while for the bottom image the stone was rotated 90 degrees.

Pleochroism (Blue) in an Irradiated Spodumene

Pleochroism (Violet) in an Irradiated Spodumene

Pleochroism (Green) in an Irradiated Spodumene

Photographs by Gagan Choudhary



Pleochroism in a Spodumene Crystal (Photo by Tino Hammid)

Kunzite (Afghanistan) 163.65 carats (Photo by Tino Hammid)

Symposium Program 2017

Speakers for the 2017 Symposium:

Elise Skalwold (Gemological Curator at Cornell University, New York):

From Gemology to Mineral Physics & Back Again Including an Update on a Gem of the Future: Nano-Polycrystalline Diamond (NPD).

Richard Hughes (Founder of Lotus Gemology, Author of Ruby & Sapphire: A Gemologist's Guide): TBA

Alan Hodgkinson (Author of Gem Testing Techniques and Visual Optics):

Pushing the Refractometer

Geoffrey Dominy (Founder of the World Gem Foundation, Author of The Handbook of Gemmology):

The Lost Art of Gem Identification

Conny Forsberg (Swedish Gem AB / Scandinavian Gem Academy):

The Story of a Crystal Showcase

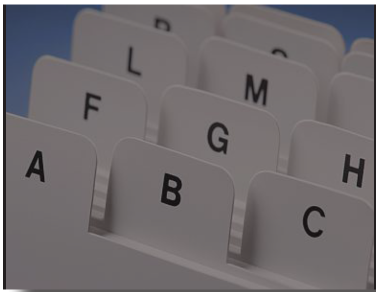
Jan Asplund (Ädelstensakademin / Scandinavian Gem Academy):

Pearl Production & Early Pearl Cultivating Experimentation in China and Sweden.

Workshops 2017

Alan Hodgkinson - Visual Optics.

Richard Drucker (Gemworld) - Coloured Gemstone Grading



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