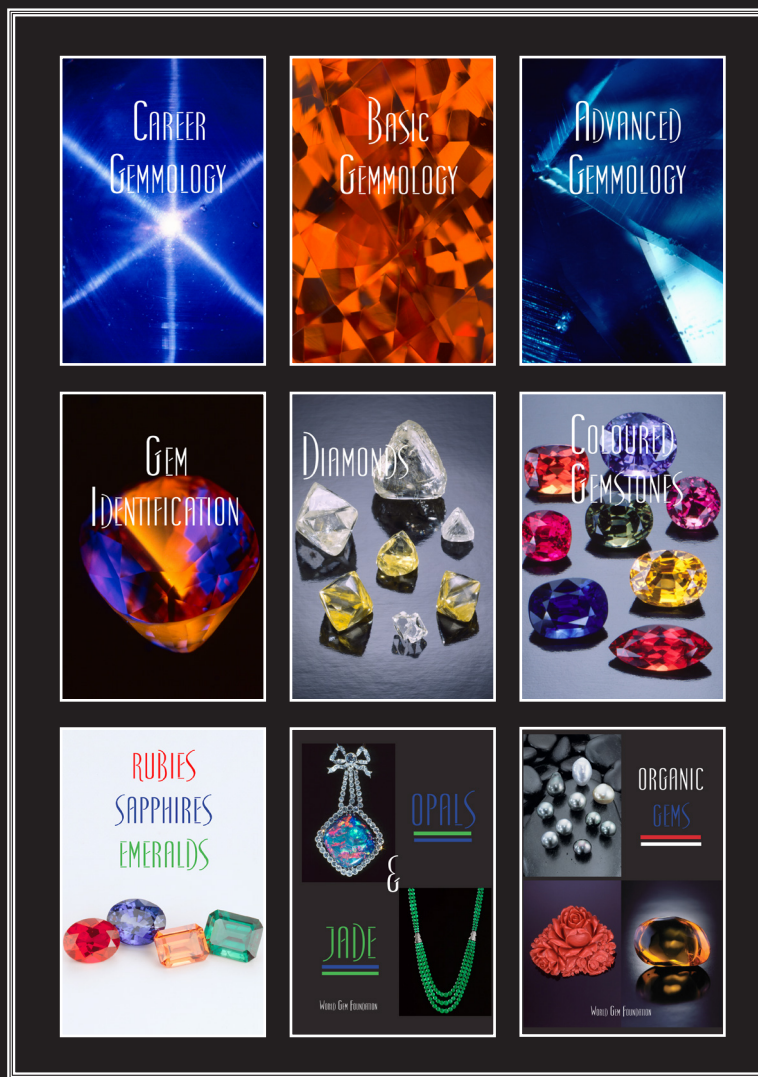




Gemmology Today

March 2021
Quarterly Publication

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In this issue

THE DAILY GRIND - Meet acclaimed gemstone cutter Michael Dyber.	5
GEMMOLOGY TODAY QUIZ #18 – This time a mini crossword!	20
MONEY CENTS – In ‘Weight Watchers’, Geoff Dominy looks at the twenty-five most valuable substances on the planet and the difference one point can make.	22
WORLD GEM FOUNDATION WORKSHOPS & COURSES	32
GRADE SCHOOL – In ‘Speaking the Same Language - Coloured Gemstones (Part One)’, Geoff Dominy looks at the communicative challenges our industry faces in the grading of gemstones.	42
TINO HAMMID MEMORIAL GEMMOLOGICAL SCHOLARSHIP – Meet the 2021 Recipients	58
OUT OF THIS WORLD – In ‘My Journey to the Micro World’, Nina Zolotukhina shares her passion for mineral and inclusion photography	62
TOUCHING HISTORY – In ‘A Glimpse into the Past - Valilocus pleristaminis’, Dr. George Poinar Jr. shows us why small can be very beautiful!	80
OUT IN THE FIELD – Gemstone Detective Kim Rix looks at the ‘Land of Hope and Glory’ and what you might expect to find when travelling throughout the Eastern USA.	83
THE SPICE OF LIFE – Dutch Gemmologist Leone Langeslag investigates the rare and mysterious Chameleon Diamond.	88
MEET THE TEAM - The faces behind the World Gem Foundation	91
ACADEMY DIRECTORY & CONTACT INFORMATION	95



Plumbogummite and Pyromorphite from China
(Photo by Nina Zolotukhina)

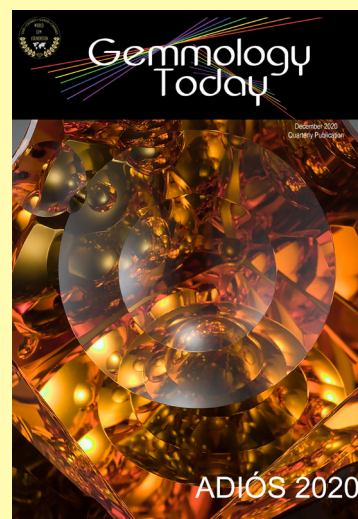
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December 2020 Issue



Editor

— at Work

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

Back in January 2020, I had the opportunity to deliver my first talk in Spanish entitled 'The Secret World of Gemstones' at el Centro para El Fomento del Empleo y Desarrollo Tecnológico del Metal (FEMPA) in Alicante.

I have lived in Spain now for 6 1/2 years and while I would like to think that my Spanish is improving, the reality is it is no where near the level it should be. A lack of time, no formal classes, general laziness (it is too easy to use Google Translate or DeepL) and living on a tourist island where English is spoken by many have all been contributing factors. I can read Spanish, I can speak Spanish but where I fall down is in 'conversational' Spanish. Spaniards generally speak very quickly and when I find myself in a group and the decibel levels are high (Spaniards also like to shout), it is hard to follow. That said, when my good friend and colleague Adolfo de Basilio suggested it, I felt up to the challenge. I rehearsed my talk for three months and while Adolfo was there to translate, I decided that I needed to try and deliver my talk in Spanish.

There were two reasons for this strategy. Firstly, I don't want to be a 'foreign' resident who expects my fellow Spaniards to speak in English. I live in Spain so therefore I should adapt to the language and the culture, not the other way around. Secondly, I wanted to emphasize the importance of speaking the same language. In our industry, we do not speak the same language when it comes to the grading of diamonds or coloured gemstones. This makes it hard to communicate effectively. At the very least, the language should be understandable, using terms that we are all familiar with.

When it comes to describing colour, GIA use hue, tone and saturation while GemDialogue uses hue, color mask and zone. So unless both people are working with the same system, it would be impossible to understand each other.

If you look at an AGS (American Gem Society) diamond certificate, you will see their terminology as well as GIA's (Gemological Institute of America) corresponding terms but if you look at a GIA diamond certificate, you will not see AGS terms used. A 'G' colour in the GIA Colour Grading System is a '1.5' in the AGS System while a VS-1 clarity grade in the GIA Clarity Grading System is a '3' using the AGS System.

This is why at the World Gem Foundation and our affiliated gem academies we teach any grading system (Diamonds and Coloured Gemstones) that is currently used in the market place. Our job is to prepare our students for the real world. So if an American student decides to work in Antwerp, they will understand the IDC (International Diamond Councils) system as well as those used by GIA, AGS, IGI, EGL, IDC and AGA.

So what's in this issue? An interview with acclaimed gem carver/cutter Michael Dyber, incredible mineral and inclusion photography from Nina Zolotukhina, I look at the 25 most valuable substances on the planet and the difference one point can make. I also start a two-part series that looks at the communicative challenges our industry faces in the grading of gemstones. Kim Rix explores gold and gemstones in the Eastern USA, Leone Langeslag investigates the rare and mysterious chameleon diamond and we have a new contributor, Dr. George Poinar Jr, whose work inspired Jurassic Park, who looks at some importance discoveries in amber. There is lots to discover! Please stay safe and where a face mask!

The Daily Grind

With my new jewelry making skills, a whole new world of design was opened. This was all good, until I realized that I wasn't involved totally in my jewelry design. You see, I had to use someone else's gems. I didn't have complete control of the process. This frustration lead me to gem carving. Another creative world was opened to me.

Meet Michael Dyber



Michael doing what he loves best (Courtesy Michael Dyber)

GT: Artist or Gem Carver; Gemstone or Art?

MD: I'm an artist first. I have been creating and selling art from my high school years. This includes metal art in stainless steel, copper, and brass.

My college years were devoted to outside sculpture in stainless steel and marble. After graduating with a degree in Humanities with a concentration in Art, I took a trip to Europe and spent some time in Florence, Italy. There I came across the Ponte Vecchio bridge of goldsmiths. I loved the workmanship and designs of these masters. With my background in sculpture, I saw their designs as miniature sculptures. At that moment, I decided to teach myself to make jewelry.

With my new jewelry making skills, a whole new world of design was opened. This was all good, until I realized that I wasn't involved totally in my jewelry design. You see, I had to use someone else's gems. I didn't have complete control of the process.

This frustration lead me to gem carving. Another creative world was opened to me.

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

MD: The most challenging gemstone is the one that is in the permanent exhibit of the National Gem Collection at the Smithsonian's National Museum of Natural History in Washington, DC.

This Ametrine Quartz was pure inspiration. A concept came to me in the night, not a design, but more of a feeling. It was 4:00 AM, I got up and went into the studio. Looking through my rough stone inventory, an Ametrine caught my eye. As always, the rough determines the preform. As the design developed, it was obvious that the project was at the top of my skill level. I learned so much about listening to myself and trusting in my ability to solve problems before me. This carving as with all my art are signed archival pieces. My designs are all spontaneous.

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

MD: The most enjoyable gemstone I have ever carved is the last one I just finished. It will be the most enjoyable until I cut the next one.

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

MD: The artistic process begins with a search through my rough stones. I'm not looking for any particular shape, color or type of stone. I'm simply waiting for an emotional feeling to a certain piece. This feeling is subtle yet recognizable over time. It calls out, this is the stone for today.

I have tried to pre-design the piece, and they do come out fine but the feeling of spontaneous creation is lost. For me, spontaneous creation is the most liberating of all emotions.

The rough is now ready to preform. Preforming is the process that prepares the rough for carving. The rough is hand held and brought to the large grinding wheels to remove sharp edges. This is a mindless process for me. I simply start to grind the rough and trust my senses.

I can't think about the cost of the lost rough in preforming. It must be spontaneous or it becomes arduous and unproductive. Some times there is an inclusion in the rough and by removing the inclusion, that action becomes the seed for the entire design

Next comes the cutting in of the design. Again, this portion is spontaneous. At a certain point my breathing slows down and I know that the design is complete. I envision that moment as a theater curtain coming down and the art is there.

What is next?

Many hours of pre-polish and more hours of polishing. This is where many fall by the wayside. You must be willing to invest in the time it takes you to bring the entire surface of the carving to a much finer surface. There are no short cuts. This stage will make or break the entire project. Do this stage perfectly no matter how long it takes and you will be rewarded with easier and more complete polish.

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?

MD: Many aspiring artist are faced with this question and there is no one answer. I can tell you that if you produce a very well executed artwork and push the limits of what has already been done, people will take notice at that moment. Remember that if you produce something new, then you must first do it better than anyone else. If not, they will do it better than you and you will loose credit. By standing out from the crowd, by your workmanship, your art will be appreciated and if you have done your very best don't be ashamed to price it accordingly. People will understand. I was told by somebody much wiser than I that, your art is only as valuable as what they will pay. Learn from that and don't get mad, listen to them.

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

MB: That moment came as I worked on my jewelry design and had to purchase someone else's gemstone. Every time I did this, I felt incomplete in the final outcome. I had some black coral and decided that I would finally break free and teach myself how to carve gem rough. Carving fit well into my sculpture background. I also made a vow to myself to only carve one of a kind pieces. This would help to push me

further into the design of my carved gems. Since I only carve and don't cut faceted or cabochon, my sculptured concepts were a perfect fit with my cast settings. This phase of my career lasted several years before I stopped making jewelry and devoted my time to mastering the art of gem carving.

GT: Natural artistic ability or a learned skill?

MD: I started my journey in gem carving not knowing where to begin. Remember, my background was in metal. So carving minerals seem to be magical. I have never had a lesson in carving. All the machinery and diamond carving tools, laps and sanding belts are made in my studio. All that I have learned has been through practice and continuing observations. This path to learning has lasted 35 years and is still viable.

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

MD: Producing art that people are not familiar with can be difficult. This is where you are given the opportunity to enlighten and educate your customer. The more you can do this, the more empowered and confident your customer will be to try what you offer. The question most asked is 'How do you do this?' You will find that people truly want to know. Be patient and stay true to your beliefs and the word will spread about your work.

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

MD: The very best place to learn gem cutting is at your local gem and mineral clubs. They are all across the country. Club members are all too willing to teach you all aspects of gem cutting. This will give you immediate access to rough stones and classes and may even be free to learn.

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

MD: That is easy. A good year for me would be an unlimited and constant supply of flawless rough.



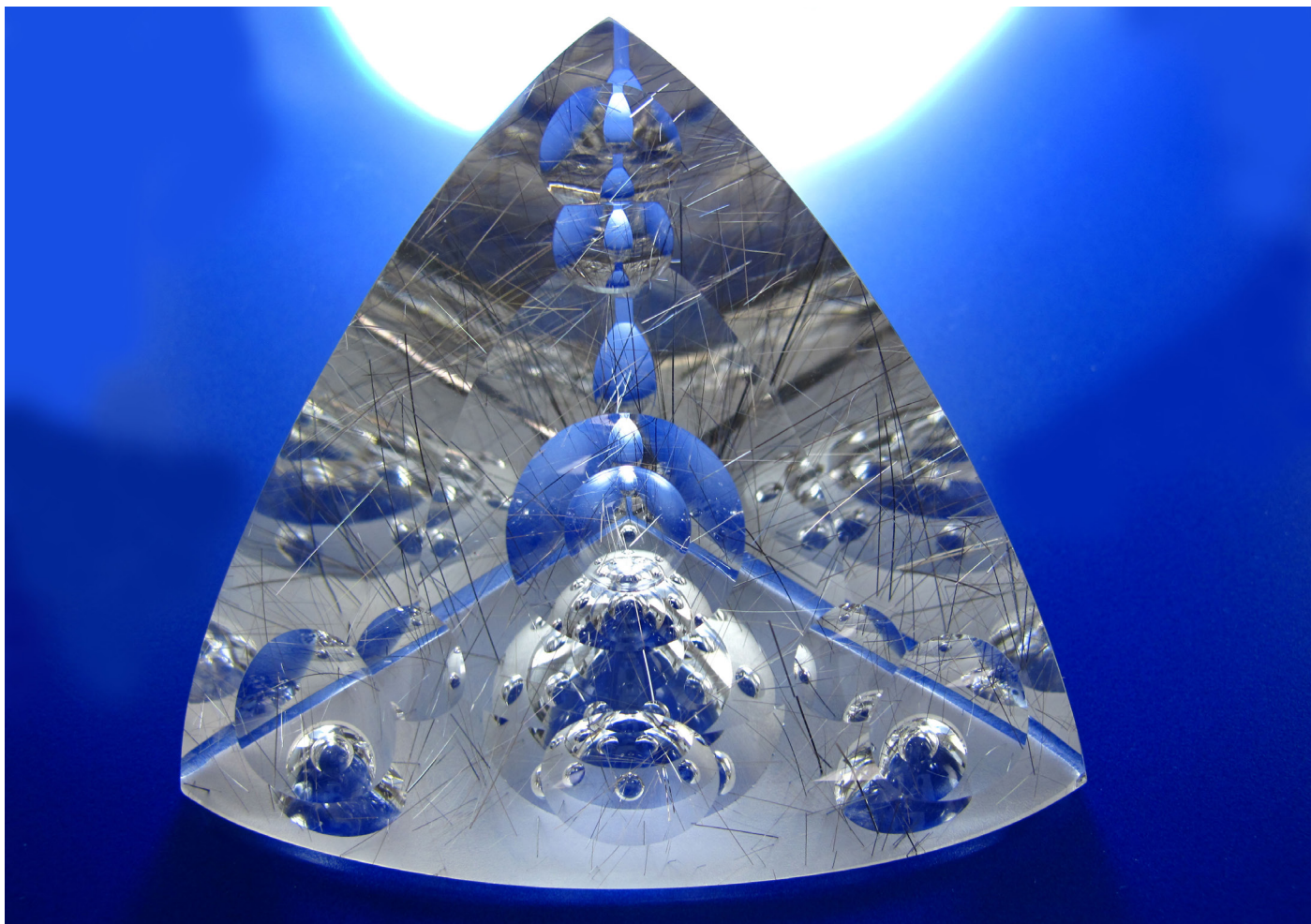
Stunning Citrine Quartz weighing 360.71 carats - Gemmology Today December 2020 Cover Shot (Photo by Tino Hammid)



Aquamarine weighing 97.84 carats (Photo by Tino Hammid)



Beryl (Ukraine) entitled 'Flora' weighing 1,754.70 carats (Photo by Sena Dyber)



Brazilian Rutilated Quartz Sculpture weighing 932.45 carats (Photo by Sena Dyber)

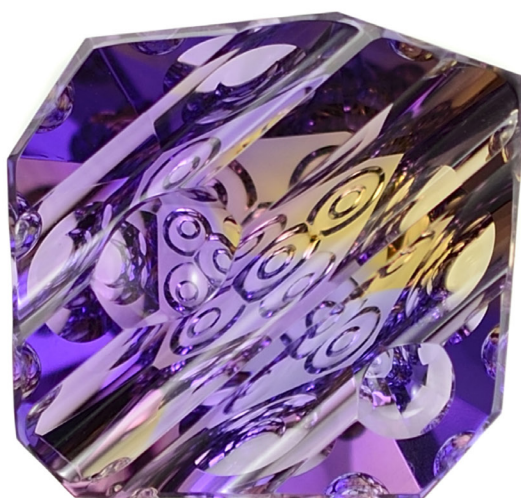


40th German Award for Jewelry & Precious Stones Idar- Oberstein 2009 (1st Place) - Brazilian Aquamarine weighing 113.24 carats (Photo by Sena Dyber)

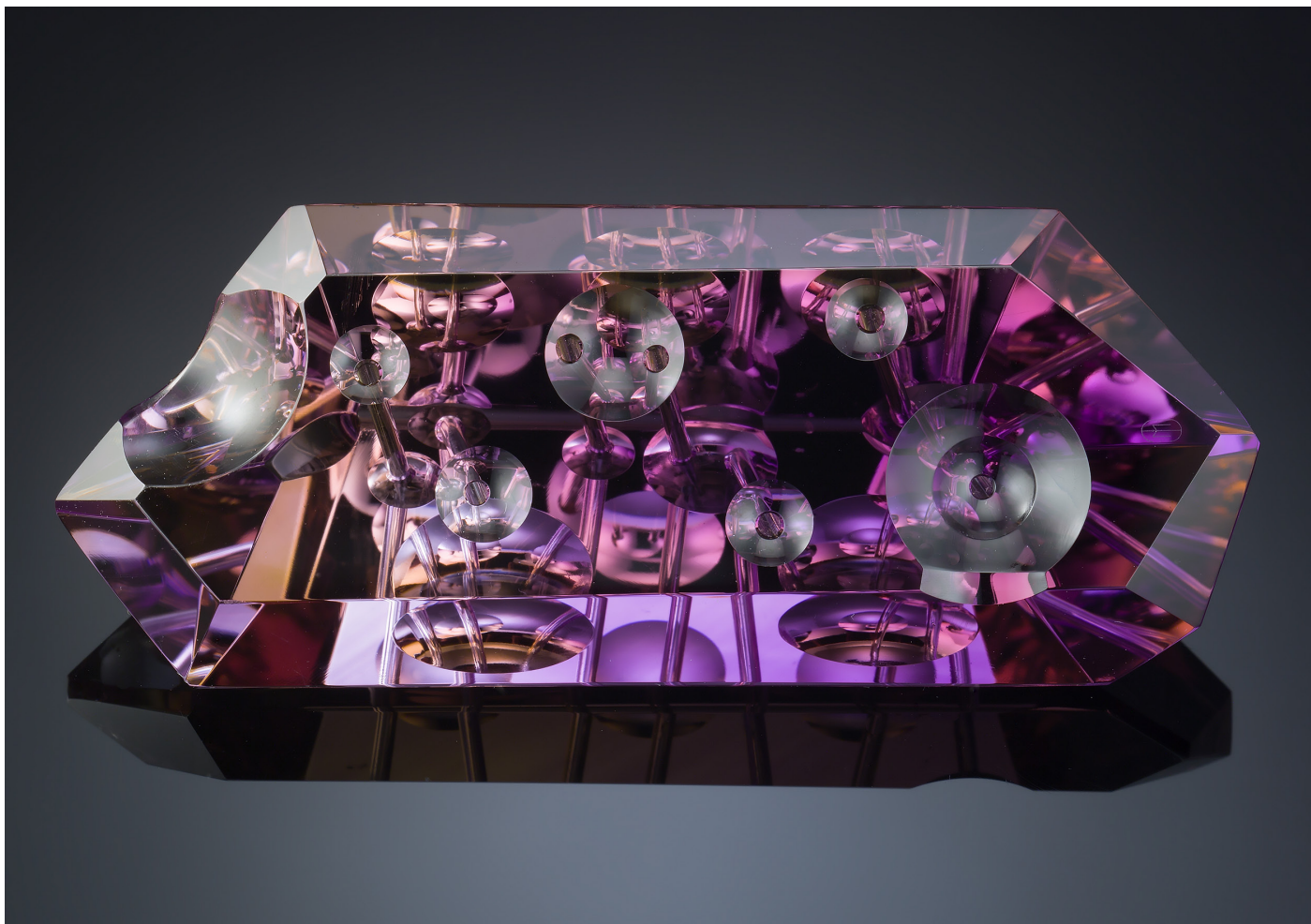
AGTA Spectrum Jewelry Competition
(1st Place - 1994)



Pendant featuring a 262.70 carat Bolivian Ametrine. Setting by Paul Gross. Designer Gold, Hanover, NH, USA (Photo by Sena Dyber)



Ametrine Quartz (Bolivia) weighing 13.94 carats (Photo by Sena Dyber)



Stunning Ametrine Quartz weighing 167.85cts (Photo by Tino Hammid)



All his flats are done by hand on a flat lap not a faceting machine (Photo by Sena Dyber)



Brazilian Aquamarine weighing 153.88 carats (Photo by Sena Dyber)



Michael builds all his carving tools including his carving arbor. Here he is seen polishing a stone (Photo by Sena Dyber)



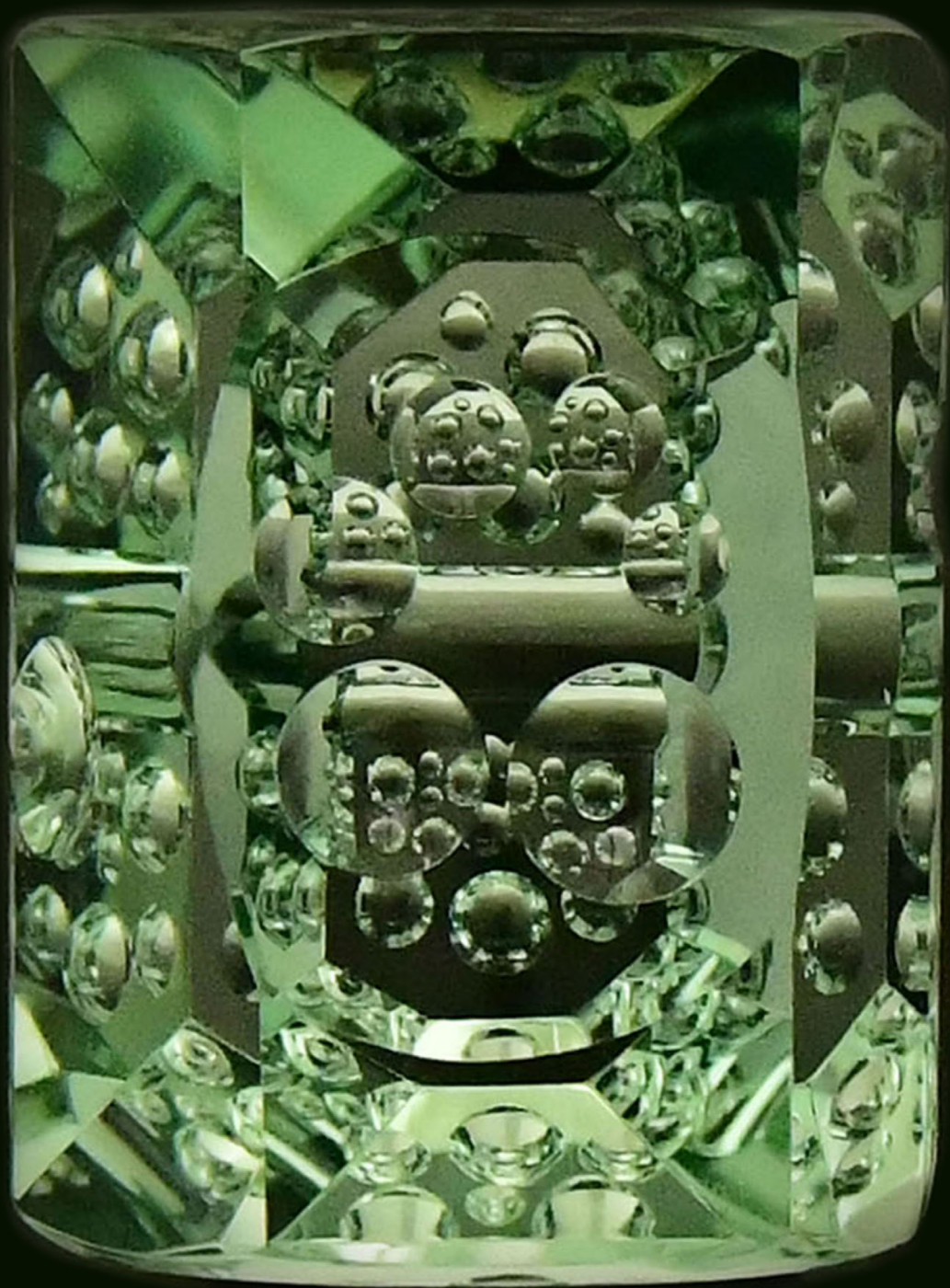
Brazilian Aquamarine weighing 31.65 carats (Photo by Sena Dyber)



50th German Award for Jewelry & Precious Stones 2019 (Winner) - Brazilian Citrine weighing 122.25 carats
(Photo courtesy of the Federal Association of the Precious Stones & Diamond Industry Idar-Oberstein, Germany)



Brazilian Beryl weighing 242.67 carats (Photo by Sena Dyber) (Both stones on this page spread came from the same crystal)



Brazilian Beryl weighing 176.25 carats (Photo by Sena Dyber) (Both stones on this page spread came from the same crystal)



Exquisite Brazilian Aquamarine weighing 164.05 carats (Photo by Sena Dyber)



'Miner's Collection' (Citrine Quartz) the best of seven years of production in Brazil (Photo by Sena Dyber)

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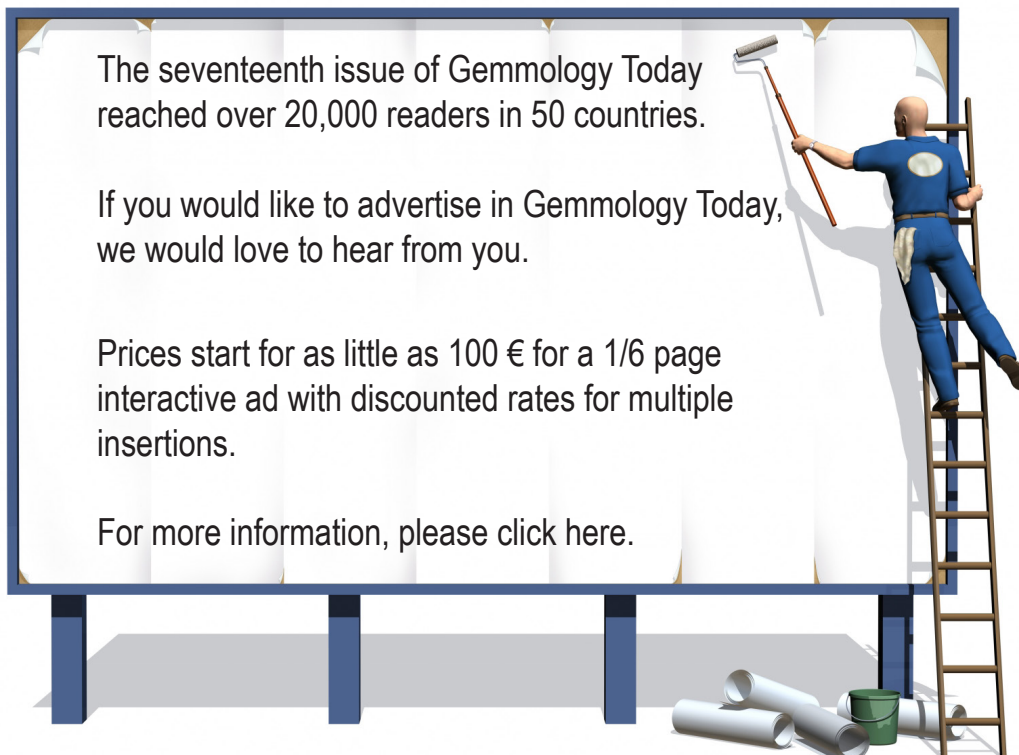
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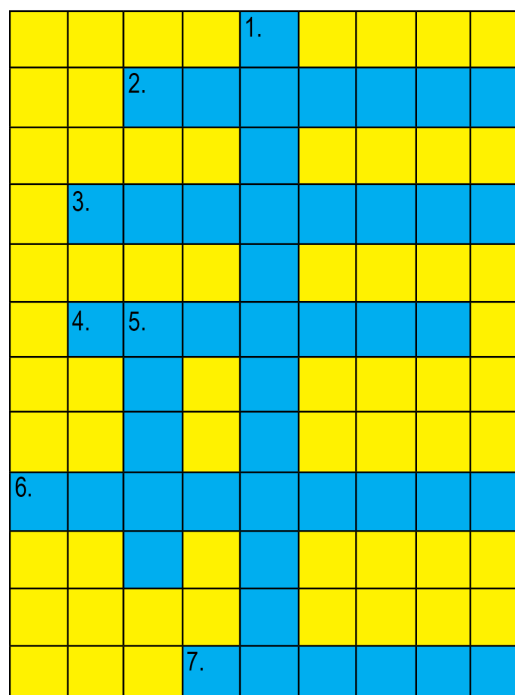
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GEMMOLOGY TODAY QUIZ #18 Mini Crossword

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answers!



ACROSS:

2. A '4 C' perhaps?
3. Zafiro in English
4. A gem that is 'green' with envy?
6. A gem fit for an astronaut?
7. A gem for a New Year's baby?

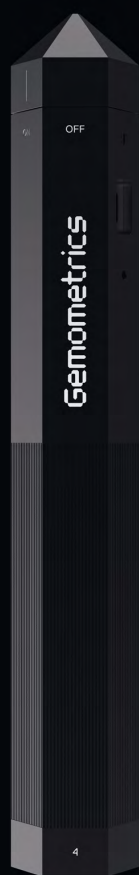
DOWN:

1. A variety of a gem that is named after a flower
5. Famous ruby producing area

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Weight Watchers



Blue Moon Diamond (Photo by Tino Hammid)

We have all been obsessed with our weight from time to time. This preoccupation normally manifests itself right after the festive season or as summer approaches. It's only natural. We live in a society where looks are important and while there is now an active campaign to counteract the stereotypes perpetrated by wafer thin models, the truth is, consciously or subconsciously, we do tend to judge a book by its cover.

It is the same in the gemstone trade. We are all familiar with the 4 C's of diamonds, the brainchild of GIA Founder Robert M. Shipley, where 'Carat Weight' along with 'Colour', 'Clarity' and 'Cut' are now considered globally as the accepted standard for describing a diamond. Carat weight is also important when it comes to the pricing of coloured gemstones with price lists, such as GemGuide, listing prices based on quality (Commercial, Good, Fine and Extra Fine) and weight.

Sadly today, too much emphasis is placed on what a gemstone weighs. Often this is to the detriment of the cut and the overall brilliance. While this might sound strange, the fact remains that most consumers and indeed a majority of those employed in our industry are blissfully unaware of the 'mechanics' of how gems are cut and priced so perhaps it is understandable. The simple fact is, when it comes to

diamonds, consumers do not want a 99-point diamond. They want a one-carat (100 points) diamond and are willing to pay a hefty premium to say they own one.

One of the key attributes of a gemstone is portability and throughout the ages, the portability of gems has made them highly desirable. While a deposed ruler may have lost his land, he did not necessarily need to lose his wealth.

Looking at the prices for precious metals today compared to diamonds, a five-carat round brilliant, D colour and Internally Flawless, weighing 1 gram will easily sell for more than \$ 500,000 USD, while the same value in gold would equate to over 9 kilograms. If it were platinum, you would need 13.59 kilograms and if it were silver, a staggering 19,394 kilograms.

If we look at fancy coloured diamonds, especially pink and blues, the appeal of portable wealth takes on a whole new meaning.

In January 2014, a record price per carat of just under \$ 865,000 USD was paid by Cora International LLC for the 29.62 carat 'Blue Moon' rough diamond from the historic Cullinan mine (formerly the Premier Mine) in South Africa.

The resultant 12.03 carat cushion modified brilliant cut 'Blue Moon' measuring 15.57mm x 13.47mm x 7.55 mm was graded as 'Fancy Vivid' blue and internally flawless by the Gemological Institute of America, premiered at the Natural History Museum of Los Angeles County on September 13, 2014 and sold for a record \$ 48.4 million USD on November 11th, 2015.

At 2.406 grams, this equates to a staggering \$ 20 million USD per gram or 20 billion USD per kilogram. That is an awful lot of gold or platinum!

Of course, diamonds are not the only attractive commodities in terms of size versus value. In an article by John Csiszar (October 22nd, 2020), he looked at the 25 most valuable substances in the World:

25. Italian White Truffles (Cost: \$7.60 per gram and up)

Truffles of all kinds are expensive, but the Italian white truffle takes the prize when it comes to value. Although delicious to many, the simple reason truffles are so expensive is that they are rare, hard to find and labour-intensive to harvest.

24. Saffron (Cost: \$10 per gram and up)

Saffron is a spice used for flavouring and colouring foods, though it has also been used in textiles, perfumes and medicine for centuries. The price of this magic seasoning starts around \$10 per gram, mainly because of the complex cultivation and harvesting process which involves plucking and drying 'threads' from the *Crocus sativus* flower, a plant not found in the wild.

23. Platinum (Cost: \$38.68 per gram)

Platinum is a beautiful precious metal that is in a similar category as gold and silver. All three of these metals are frequently traded in the global markets, and all three are often used for beautiful objects like jewellery. Platinum is actually thirty times rarer than gold and far more durable.

22. Beluga Caviar (Cost: Up to \$35 per gram)

Beluga is a specific type of caviar that is the most expensive in the world. It comes from the rare beluga sturgeon, which is found in the Caspian Sea. In addition to its long reproductive cycle, the beluga sturgeon is currently the victim of overfishing due to its precious cargo of eggs, something, which further drives up the price.

21. Iridium (Cost: \$53.37 per gram)

Iridium is a hard, silvery metal that is one of the rarest in the world. It is also extremely corrosion resistant. Iridium is mainly used as a hardening agent for platinum.

20. Gold (Cost: \$55.55 per gram)

Gold has been valuable since time immemorial because it is beautiful and has always been seen as a store of wealth. Among other characteristics, gold also possesses the unusual combination of being both extremely malleable and yet nearly indestructible.

19. Palladium (Cost: \$76.29 per gram)

This shiny white metal is more valuable than gold. Demand has been skyrocketing recently, with the price more than doubling since early 2019. Like rhodium, palladium's major use is in catalytic converters. South Africa and Russia produce the majority of the world's palladium.

18. Rhodium (Cost: \$894.00 per gram)

Rhodium is a precious metal that can have a volatile price, just like gold or silver. However, rhodium's primary use is not for jewellery but rather for catalytic converters. As global emission standards for vehicles tighten, rhodium becomes more in demand. In 2019 alone, the price of rhodium jumped 151%, according to CNBC.

17. Agarwood (Cost: \$1,000 per gram)

Long hailed as 'The Wood of the Gods' agarwood can be found in certain *aquilaria* trees after they become contaminated with *Phialophora parasitica*, a type of mold. The infected wood produces a distinctly aromatic resin called aloes. Not to be confused with the aloe found in skin care products, these aloes are valued primarily for their one-of-a-kind scent and used in perfumes and incenses.

16. Da Hong Pao Tea (Cost: \$1,400 per gram)

Da Hong Pao Tea is a rare rock tea that is only produced in one place in the world, Wuyishan, Fujian. While the harvesting of the original tree that produced Da Hong Pao Tea is no longer allowed, the related teas are. While paying that much for Da Hong Pao may not be everyone's cup of tea, for others, it can be a 'once-in-a-lifetime' experience.

15. Coral Snake Venom (Cost: \$4,000 per gram)

Coral snake venom is among the most lethal in the world, second only to that of the black mamba. Researchers are working on synthesizing the venom into a variety of medical purposes.

14. Plutonium (Cost: \$4,400-\$5,600 per gram)

The devastating power of nuclear weapons probably makes plutonium more well-known than it otherwise might be. However, it is also used as a fuel for nuclear reactors. No matter what its use, this radioactive element is hard to come by and quite expensive.

13. Taaffeite (Cost: \$11,250 per gram)

Taaffeite is a very rare, light violet gemstone that is far more rare than a diamond. The gem is named after its discoverer, Austrian geologist Richard Taaffe, who found the first stone in 1945. Taaffeite has thus far only been unearthed in Tanzania and Sri Lanka.

12. Benitoite (Cost: \$12,100 per gram and up)

Benitoite is another rare gem that resembles a sapphire and is almost exclusively found in California's San Benito County.

11. Soliris (Cost: \$21,508 per gram)

Soliris is a highly valuable drug that most people have likely never heard of. However, it is vitally important for patients who have the extremely rare neuromyelitis optica spectrum disorder, known as NMOSD.

10. Tritium (Cost: \$30,000 per gram)

Tritium is the sole radioactive isotope of hydrogen. It is most commonly found in the form of water. Even though it is expensive, tritium is still used in a wide range of consumer products, as it can energize light-producing phosphors in items such as watch dials, gun sights and exit signs.

9. Red Beryl (Cost: \$50,000 per gram)

Red beryl is an extremely rare gemstone. For every 150,000 diamonds mined, only one red beryl is found. A 2-carat red beryl is considered to be as rare a find as a 40-carat diamond. This rare stone is only found in the U.S.

8. Serendibite (Cost: \$90,000 per gram)

Serendibite is known as a borosilicate mineral, and it is only found in 20 locales around the world. Only two areas are said to produce 'quality' serendibite, namely Mogok in northern Myanmar and Ratnapura in Sri Lanka.

7. Grandidierite (Cost: \$100,000 per gram or more)

Grandidierite is a gemstone that is a close cousin to serendibite, and both are extremely valuable. Grandidierite is named after its discoverer, Alfred Grandidier, who found the blue, green and white stone in Sri Lanka. At the time of the initial discovery, grandidierite was thought to be serendibite, but it was determined to be its own new gemstone upon further examination.

6. Diamond (Cost: \$67,500 to \$487,000 per gram based on a one to five-carat D/IF diamond)

Due to clever marketing and controls, diamonds are actually priced at a level above their natural supply and demand

levels. In reality, they are not nearly as uncommon as many of the gemstones on this list.

5. Painite (Cost: \$300,000 per gram)

If you have never heard of painite, you are not alone. Painite is a very rare borate mineral. British mineralogist and gem dealer Arthur C.D. Pain first discovered it in Myanmar. It was initially misidentified as ruby, until it was discovered as a new gemstone in the 1950s. Myanmar remains the sole source of painites.

4. Red Diamonds (Cost: \$5 million per gram)

Red diamonds are the rarest version of coloured diamonds in the world, with no specimens at all being presented to the Gemological Institute of America for grading from 1957 to 1987, an impressive 30-year span. Most of the world's true red diamonds have been produced by Western Australia's Argyle mine, which is slated for closure in 2020, perhaps making red diamonds even rarer.

3. Californium 252 (Cost: \$27 million per gram)

Californium is a rare element that is man-made and not found in nature. As the name suggests, the element was first created in the University of California's Radiation Lab in Berkeley. Thanks to its radioactive properties, CF-252 is used in a range of applications, from scanners and reactor start-up rods to Prompt Gamma Neutron Activation Analysis, or PGNA.

2. Endohedral Fullerenes (Cost: \$138.2 million per gram)

Endohedral fullerenes are complex chemical structures that are made of carbon atoms with a nitrogen atom inside. They have the ability to encapsulate other atoms within their cage-like design. They are very difficult to synthesize, which contributes to their astronomical price.

1. Antimatter (Cost: \$62.5 trillion per gram)

Antimatter is considered to be the most expensive substance on Earth because it requires an incredible amount of energy to generate. According to CERN, it requires several hundred million pounds just to create one-billionth of a gram of antimatter. It also happens to be extremely dangerous, as it annihilates any matter that it may come into contact with in a huge explosion, the size of which is determined by Einstein's famous $E=mc^2$ equation.

It is interesting to note that eight of the twenty-five most valuable substances listed belong to the mineral kingdom although it is clear that John's list is far from complete. At \$20 million USD a gram for the 'Blue Moon' Diamond, one would expect to see natural blue diamonds on his list.



In 1987, the .95 carat 'Hancock Red' diamond, sold at Christie's for an astonishing \$ 880,000 USD (Photo by Tino Hammid)

It did get me thinking about the hierarchy of gemstones. The following list is based on GemGuide and includes ninety-one gemstones and how they are ranked 'per gram'

in USD based on a five-carat 'extra fine' quality (in the case of coloured gemstones), FL-VVS for the fancy coloured diamonds and D-IF for a colourless diamond:

No.	Gemstone	Price per Carat	Price per Gram	Price per Point
1	Diamond (Fancy Intense Pink)	1000000	5000000	10000
2	Diamond (Fancy Pink)	432000	2160000	4320
3	Diamond (Fancy Brownish-Pink)	183000	915000	1830
4	Diamond (Fancy Light Pink)	170000	850000	1700
5	Corundum (Ruby - Burmese - Unenhanced)	130000	650000	1300
6	Diamond (Fancy Light Brownish-Pink)	125000	625000	1250
7	Diamond (D - IF)	97400	487000	974
8	Tourmaline (Paraíba)	60000	300000	600
9	Corundum (Ruby - Mozambique - Unenhanced)	49000	245000	490
10	Chrysoberyl (Alexandrite)	40000	200000	400
11	Corundum (Ruby - Non-Specific - Heated)	28500	142500	285
12	Diamond (Fancy Intense Yellow)	27500	137500	275
13	Corundum (Sapphire Blue - Burma Unenhanced)	19500	97500	195
14	Diamond (Fancy Yellow)	18000	90000	180
15	Corundum (Sapphire Padparadscha)	16000	80000	160
16	Tourmaline (Cuprian)	14000	70000	140
17	Emerald (Colombian)	13500	67500	135
18	Corundum (Sapphire Blue - Sri Lanka Unenhanced)	13000	65000	130
19	Diamond (Fancy Brownish Yellow)	12500	62500	125
20	Diamond (Fancy Intense Brownish Yellow)	12000	60000	120
21	Corundum (Star Ruby)	10650	53250	106.5
22	Corundum (Sapphire Pink Unenhanced)	10300	51500	103
23	Emerald (Zambian)	9950	49750	99.5
24	Emerald (Non-Specific)	9700	48500	97
25	Emerald (Brazil)	9500	47500	95
26	Diamond (Fancy Brown)	9000	45000	90
27	Garnet (Tsavorite)	8500	42500	85
28	Diamond (Fancy Light Yellow)	8500	42500	85
29	Spinel (Red)	7500	37500	75
30	Diamond (Fancy Light Brownish Yellow)	7500	37500	75
31	Diamond (Fancy Light Brown)	7000	35000	70
32	Corundum (Sapphire Blue - Non Specific)	6600	33000	66
33	Corundum (Sapphire Pink)	6300	31500	63
34	Chrysoberyl (Cat's Eye))	6000	30000	60
35	Corundum (Ruby - Cabochon)	5200	26000	52
36	Garnet (Demantoid)	5000	25000	50
37	Corundum (Sapphire Colour Change)	4800	24000	48
38	Corundum (Star Sapphire Blue)	4500	22500	45
39	Corundum (Sapphire Orange)	4500	22500	45
40	Spinel (Pink)	4500	22500	45
41	Corundum (Sapphire Purple Unenhanced)	4200	21000	42
42	Topaz (Pink)	4200	21000	42
43	Spinel (Blue)	3300	16500	33
44	Corundum (Yellow Sapphire - Unenhanced)	2600	13000	26
45	Topaz (Imperial)	2500	12500	25

No.	Gemstone	Price per Carat	Price per Gram	Price per Point
46	Garnet (Grossular Mint)	2250	11250	22.5
47	Corundum (Sapphire Blue - Cabochon)	2000	10000	20
48	Corundum (Sapphire Green)	1800	9000	18
49	Corundum (White Sapphire)	1600	8000	16
50	Garnet (Colour Change)	1600	8000	16
51	Corundum (Yellow Sapphire)	1375	6875	13.75
52	Spinel (Lavender)	1135	5675	11.35
53	Tourmaline (Chrome)	1000	5000	10
54	Aquamarine	950	4750	9.5
55	Tourmaline (Indicolite)	950	4750	9.5
56	Garnet (Spessartite - Mandarin)	900	4500	9
57	Topaz (Yellow)	675	3375	6.75
58	Tourmaline (Blue/Green)	650	3250	6.5
59	Tourmaline (Bi-colour)	600	3000	6
60	Tourmaline (Green)	600	3000	6
61	Zosite (Tanzanite)	600	3000	6
62	Tourmaline (Red)	575	2875	5.75
63	Tourmaline (Cat's Eye)	500	2500	5
64	Tourmaline (Pink)	475	2375	4.75
65	Andalusite	450	2250	4.5
66	Garnet (Spessartite)	450	2250	4.5
67	Chrysoberyl Yellow/Green)	400	2000	4
68	Peridot	385	1925	3.85
69	Beryl (Green)	375	1875	3.75
70	Feldspar (Orange Sunstone)	360	1800	3.6
71	Beryl (Pink)	350	1750	3.5
72	Zircon (Blue)	350	1750	3.5
73	Apatite (Blue/Green)	240	1200	2.4
74	Garnet (Hessonite)	225	1125	2.25
75	Feldspar (Rainbow Moonstone)	220	1100	2.2
76	Garnet (Rhodolite)	200	1000	2
77	Iolite	165	825	1.65
78	Zircon (Brown)	165	825	1.65
79	Beryl (Golden-Yellow)	135	675	1.35
80	Spodumene (Kunzite)	135	675	1.35
81	Feldspar (Moonstone)	120	600	1.2
82	Diopside Chrome	100	500	1
83	Garnet (Pyrope)	80	400	0.8
84	Corundum (Black Star Sapphire)	70	350	0.7
85	Quartz (Amethyst)	60	300	0.6
86	Garnet (Almandine)	50	250	0.5
87	Quartz (Ametrine)	42	210	0.42
88	Quartz (Madeira Citrine)	40	200	0.4
89	Quartz (Citrine)	35	175	0.35
90	Quartz (Green)	25	125	0.25
91	Topaz (Blue)	22	110	0.22



Padparadscha Sapphire and Diamond Ring (Photo by Tino Hammid)

For those knowledgeable in the pricing of gemstones, there should not be any surprises here with fancy diamonds possessing any form of pinkish colouration, Burmese and Mozambique unenhanced rubies and Padparadscha sapphires all making the Top Ten.

However while both of the aforementioned comparisons are based on a 'per gram' price, we should not forget the extraordinary impact even 2 milligrams can have on the price of a gemstone. Remember earlier I talked about consumers wanting a one-carat diamond, not a 99-point diamond. How much difference can one point make?

Before we look at the impact one-point can have on the overall price, it would be helpful to understand exactly what one-point is. If I were to tell you that one-point equals 2 milligrams or 0.000070548 ounces (if you still work in the Imperial System), I doubt many of you would be able to envision what this really means. Let's try something a little less abstract.

If you were to take a one-dollar USD bill and cut it into 500 identical pieces, each piece would weigh the equivalent of one point. That's right, a one-dollar USD bill weighs exactly one gram (1000 milligrams). One carat is equal to 1/5th of a gram or 200 milligrams.



In terms of overall dimensions, if we assume that a 1.00ct ideal cut diamond measures 6.50mm (in diameter) x 3.90mm (total depth), a .99ct diamond, with the same diameter, would have a total depth of 3.84mm, a mere 0.06mm difference!

Now let's look at the real 'magic' two milligrams can have on a round brilliant cut diamond, D colour, IF.....

Premiums

In an attempt to lessen the impact one point can have on the value of a diamond when moving from one weight category to the next, GemGuide and Rapaport both include 'premiums'. In reality, these premiums are supposed to provide incentives for cutters who choose to sacrifice weight for overall brilliance.

In the case of GemGuide, these premiums are:

Weight Categories	Premium
.60ct to .69ct	5% to 10%
.85ct to .89ct	5% to 10%
.95ct to .99ct	5% to 20%
1.20ct to 1.49ct	7% to 12%
1.70ct to 1.99ct	10% to 20%
2.50ct to 2.99ct	5% to 12%
3.50ct to 3.99ct	5% to 12%
4.50ct to 4.99ct	5% to 12%
5.50ct to 5.99ct	3% to 12%
6.00ct to 6.99ct	10% to 15%
7.00ct to 7.99ct	15% to 25%
8.00ct to 8.99ct	20% to 30%
9.00ct to 9.99ct	25% to 35%
10.00ct to 14.99ct	35% to 50%

Rapaport also include additional premiums for diamonds that fall short of the next highest weight category and state 'Prices for select excellent cut large 3 to 10 carat+ sizes may trade at significant premiums to the Price List in speculative markets.' For round brilliant cuts, their premiums are:

Weight Categories	Premium
.60ct to .69ct	7% to 10%
.80ct to .89ct	7% to 12%
.95ct to .99ct	5% to 10%
1.25ct to 1.49ct	5% to 10%
1.70ct to 1.99ct	7% to 12%
2.50ct +	5% to 10%
3.50ct +	5% to 10%
4.50ct +	5% to 10%



Natural Pink Diamond (Photo by Tino Hammid)

Carat Weight	Price per Carat	Premium %	Adjustment in USD	Adjusted Price per Carat	% Difference (One Point)	Value of Point	Point Value per Gram
0,49	3800	0	0	3800			
0,50	5040	0	0	5040	+33%	658	329000
0,69	5040	10	504	5544			
0,70	7280	0	0	7280	+31%	1270	635000
0,89	7280	10	728	8008			
0,90	11900	0	0	11900	+49%	3582	1791000
0,99	11900	20	1190	13090			
1,00	13500	0	0	13500	+3%	540	270000
1,49	13500	12	1350	14850			
1,50	19875	0	0	19875	+34%	7686	3843000
1,99	19875	20	1987.5	21862.5			
2,00	27500	0	0	27500	+26%	11494	5747000
2,99	27500	12	2750	30250			
3,00	50000	0	0	50000	+65%	59552	29776000
3,99	50000	12	5000	55000			
4,00	52000	0	0	52000	-5.5%	-11450	-5725000
4,99	52000	12	5200	57200			
5,00	97400	0	0	97400	+70%	201572	100786000

But do these premiums work? If we look at the table above (based on GemGuide), one would have to say no.

I know the chart may look confusing at first but let's look at what happens when a round brilliant diamond moves from 69-points to 70-points.

A 69-point diamond will have a 10% premium added to the price per carat increasing the initial \$ 5040/ct price to \$ 5544/ct USD. A 70-point diamond is priced at \$ 7280/ct USD, a difference of 31%. At \$ 5544/ct, a 69-point diamond would be priced at \$ 3826 USD while the 70-point diamond would be priced at \$ 5096 USD. A difference of \$ 1270 USD for one-point or \$ 635,000 per gram!

Billion Dollar Babies

However things get really crazy when we look at what happens when a diamond moves from 4.99 carats to 5.00 carats. Incredibly that one point, 2 milligrams or 1/500th of a one dollar US bill would make a difference of as much as one billion dollars USD if we were to use the 'per gram' pricing module previously discussed.....that's ONE BILLION DOLLARS!

Coloured Gemstones

Does one point have the same impact on the value of coloured gemstones?

Well you could be excused for thinking that the impact would not be as great as it is with diamonds. After all, there is no De Beers-like marketing machine driving the coloured

gemstone market and colour and clarity (rather than cut) account for the lion's share of the value but wait.....

If we look at the chart on the opposing page based again on GemGuide and the 'Price per Carat' for a 2.99 carat stone (Extra Fine Quality) (Column A), the 'Price per Carat' for a 3.00 carat stone (Extra Fine Quality) (Column B) and the difference one point makes to the overall price (Column C) in USD, we can see that it can be quite dramatic especially if we look at unenhanced Burmese rubies. One point here equals over \$ 100,000 USD or over \$ 50 million a gram!



Natural Ruby (Photo by Tino Hammid)

No	Gemstone	Column A	Column B	Column C	Point Value Per Gram
1	Corundum (Ruby - Burmese - Unenhanced)	59500	93000	101095	50547500
2	Corundum (Ruby - Mozambique - Unenhanced)	24000	33000	27240	13620000
3	Tourmaline (Paraiba)	47000	55000	24470	12235000
4	Corundum (Ruby - Non-Specific - Heated)	13200	21000	23532	11766000
5	Tourmaline (Cuprian)	8500	13500	15085	7542500
6	Chrysoberyl (Alexandrite)	33500	37500	12335	6167500
7	Corundum (Star Ruby)	3600	7125	10611	5305500
8	Garnet (Tsavorite)	2250	5250	9022.5	4511250
9	Corundum (Sapphire Padparadscha)	8000	10350	7130	3565000
10	Corundum (Star Sapphire Blue)	1650	3500	5566.5	2783250
11	Corundum (Sapphire Blue - Burma Unenhanced)	9950	11700	5349.5	2674750
12	Chrysoberyl (Cat's Eye)	4500	6000	4545	2272500
13	Corundum (Sapphire Pink Unenhanced)	6000	7000	3060	1530000
14	Topaz (Imperial)	1250	2250	3012.5	1506250
15	Topaz (Pink)	2150	3000	2571.5	1285750
16	Corundum (Sapphire Blue - Sri Lanka Unenhanced)	7200	8000	2472	1236000
17	Spinel (Red)	5250	6000	2302.5	1151250
18	Corundum (Sapphire Colour Change)	2150	2875	2196.5	1098250
19	Emerald (Colombian)	10000	10650	2050	1025000
20	Corundum (Sapphire Blue - Non Specific)	3400	4000	1834	917000
21	Emerald (Zambian)	8000	8500	1580	790000
22	Spinel (Pink)	3500	4000	1535	767500
23	Tourmaline (Indicolite)	425	800	1129.25	564625
24	Emerald (Non-Specific)	8250	8500	832.5	416250
25	Emerald (Brazil)	7750	8000	827.5	413750
26	Spinel (Blue)	950	1200	759.5	379750
27	Tourmaline (Green)	425	550	379.25	189625
28	Tourmaline (Blue/Green)	500	600	305	152500
29	Tourmaline (Red)	450	550	304.5	152250
30	Tourmaline (Bi-colour)	400	500	304	152000
31	Tourmaline (Cat's Eye)	200	300	302	151000
32	Aquamarine	720	800	247.2	123600
33	Zircon (Blue)	250	325	227.5	113750



Number Six - Alexandrite in Daylight (Left) and under Incandescent Light (Right) (Photos by Tino Hammid)

Studying Gemmology with the World Gem Foundation

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

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

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

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

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

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

Career Gemmologist Program

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

Gemmology Seven

This option allows you to complete the entire theoretical requirements by enrolling in our Career Gemmology course (5 modules - 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 60 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, HPHT, CVD, Detonation, Ultrasonic Cavitation Skull Crucible, Zone Melt, Horizontally Oriented Crystallization, the Sublimation Method, and the Modified Stöber Method) but also the unique identifying features that allow us to separate them from their natural counterparts.

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

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

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

The next module looks specifically at diamonds, their physical and optical properties, geology, localities, principle mines, crystal system, chemical composition and classification, causes of colour (fancy coloured diamonds), absorption spectra, inclusions, fluorescence, diamond cutting and mining 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, pricing and care guidelines. Gemstones covered include corundum, beryl, chrysoberyl, spinel, zircon, topaz, tourmaline, peridot, quartz, garnet, tanzanite, lapis lazuli, turquoise, spodumene, feldspars, iolite, andalusite, diopside, apatite, and organic gems (pearls, coral, jet, ivory, and amber). You will also learn about the various colour grading systems currently used (GIA, Gemewizard, GemDialogue and the World of Color) including how to accurately describe colour based on hue, tone and saturation, the clarity classification of gemstones, how cut is assessed, opal, jadeite and pearl grading, and how to estimate the weight of 'mounted' stones.

The study of gemmology simply would not be complete without a comprehensive program of practical instruction. This involves five practical workshops (Gem Identification #1 & #2, Diamond Grading and Lab-created Diamonds, Lab-created and Treated Gems and Coloured Gemstone Grading #1) totalling twenty-eight days of in-class instruction and a 60 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 60 hour online course.

Diamond Professional Program

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

Coloured Gemstone Professional Program

If your area of expertise is coloured gemstones, this program is ideally suited for you. The Coloured Gemstone Professional program involves the completion of four theoretical courses (Basic Gemmology, Advanced Gemmology, Gem Identification and Coloured Gemstones) plus our two five-day practical Gem Identification workshops, our five-day Coloured Gemstone Grading #1 workshop, our five-day Lab-created and Treated Gems workshop plus our 60 hour online Coloured Gemstone Grading #2 course.

Residency Programs

We are delighted to announce that our Career Gemmologist, Diamond Professional and Coloured Gemstone Professional Diploma Programs are now available as a full-time residency program through the French-Swiss Gem Academy in Nice, France and the Gem Academy of Canada in Montreal, Canada.

Integrating the theoretical and practical components of these programs, students can earn their Career Gemmologist Diploma in six-months, their Diamond Professional in one month and their Coloured Gemstone Professional Diploma in five months.

Courses in Other Languages

All of our diploma courses are now available in English, Spanish & French. Our three general interest courses are also available in English & French and will be available in Spanish in early 2021.

General Interest Courses

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

Rubies, Sapphires & Emeralds

This course focuses on three coloured gemstones (rubies, sapphires and emeralds) that individually and collectively are considered the cornerstones of the coloured gemstone trade.

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

Opals and Jade

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

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

Organic Gems

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

Online Tutoring

While clearly the ideal way to learn a particular subject is in a classroom or with one-on-one tutoring, we appreciate that this is difficult when you enrol in a long distance study program. Fortunately, new distance learning technologies are changing. Now teachers can connect with their students virtually using a variety of virtual tutoring tools, such as Skype.

The chart outlines the number of online tutoring hours that are included in our courses. If you require additional tutoring, you can talk to your tutor to discuss availability and pricing.

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

Once a Student, Always a Student

We appreciate that the science of gemmology is constantly evolving. Every year new lab-created gemstones and treatments and enhancements are emerging in the market place along with new techniques and advanced technology to detect them. While your knowledge in certain areas may be relevant today, it may be obsolete tomorrow.

To meet this challenge, the World Gem Foundation has introduced our 'One a Student, Always a Student' policy, an innovative program that is unique to the World Gem Foundation and our affiliated gem academies.

Once you register for one of our courses or programs, we provide you with lifetime access to your student page so that every two years when we update our courses, you will receive the latest digital course notes free of charge.

Flexible Study Schedules

Benjamin Franklin once said 'An investment in knowledge pays the best interest' and this is as true today as it was back then. But how can we achieve this when we all lead such busy lives?

At the World Gem Foundation, we appreciate that we all have responsibilities and commitments that can make studying a challenge.

To meet this challenge, we offer a flexible study schedule that allows you to register at any time and study at your own pace.

Enrol in one of our three diploma programs, take the theory and practical diploma courses separately and receive course credits or take our general interest courses. The choice is yours! Our goal is to help you devise a study schedule that works for you!

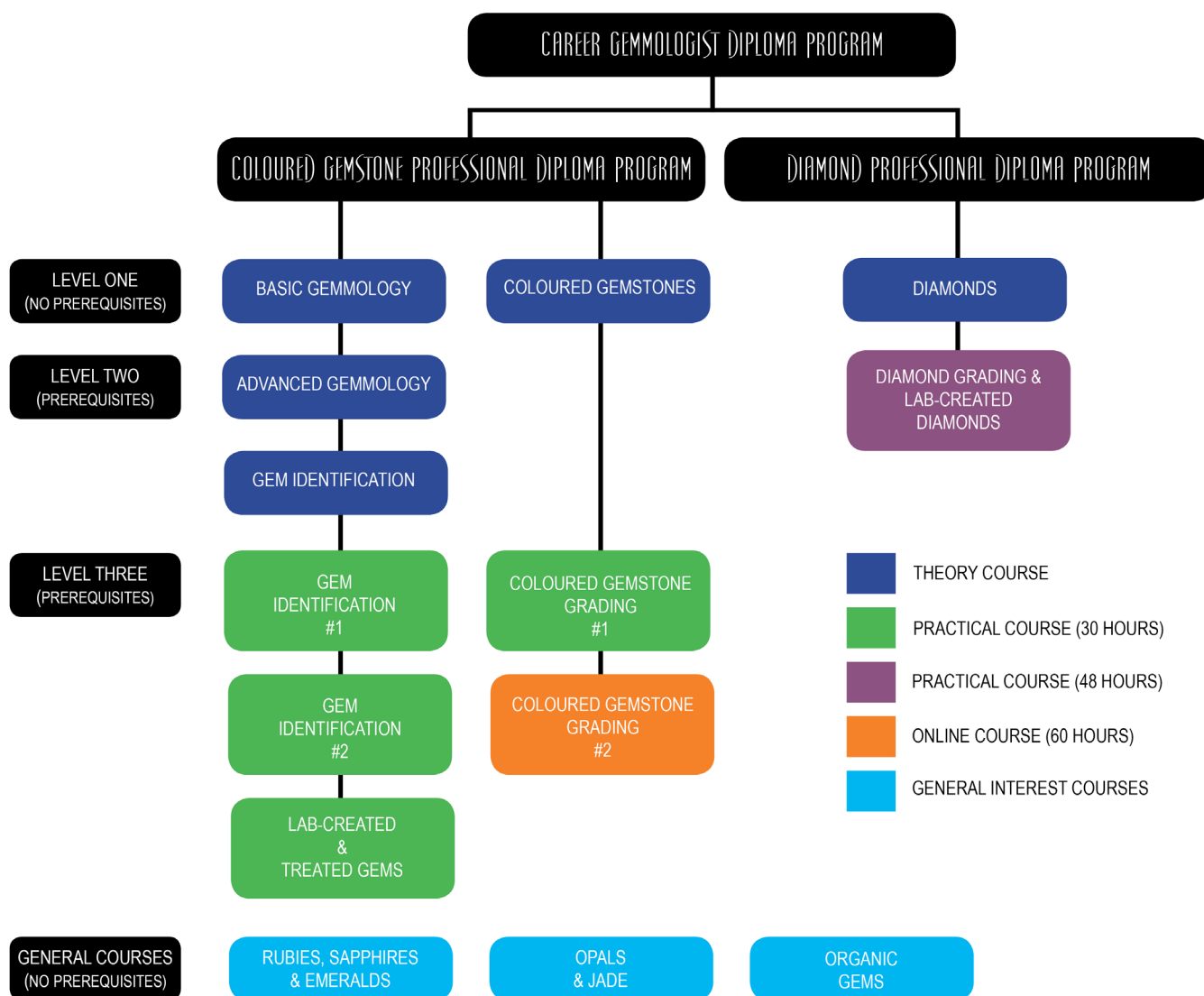
Whether you are taking our online tests, writing our final theoretical examinations or taking a practical test, we provide you with the flexibility to make it possible. Our students are our major stakeholders and we believe it is our responsibility to offer them every opportunity to achieve their educational goals.

Available in Print

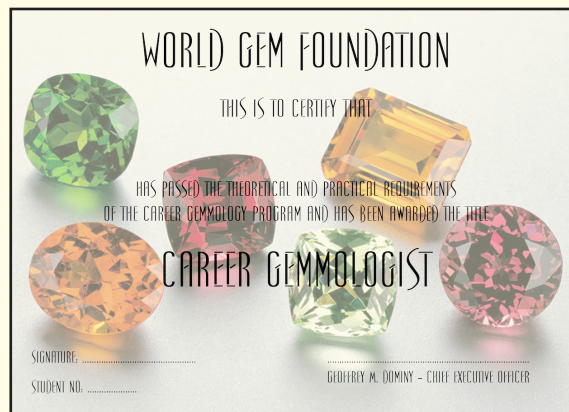
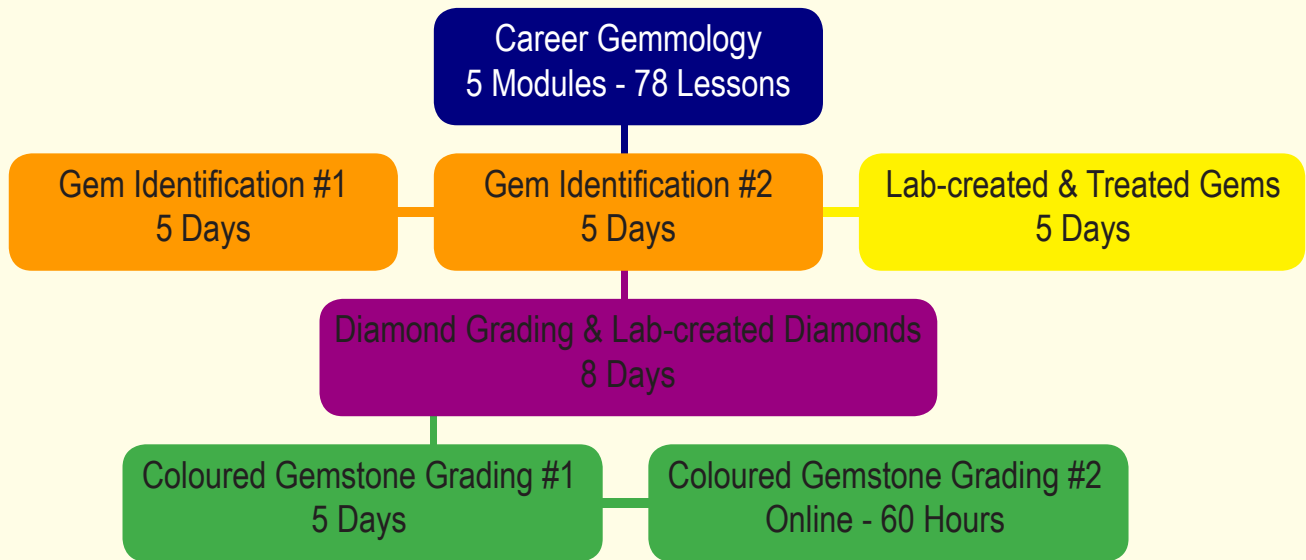
All our diploma theoretical courses are available in print.

Course Fees

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



GEMMOLOGY SEVEN PROGRAM

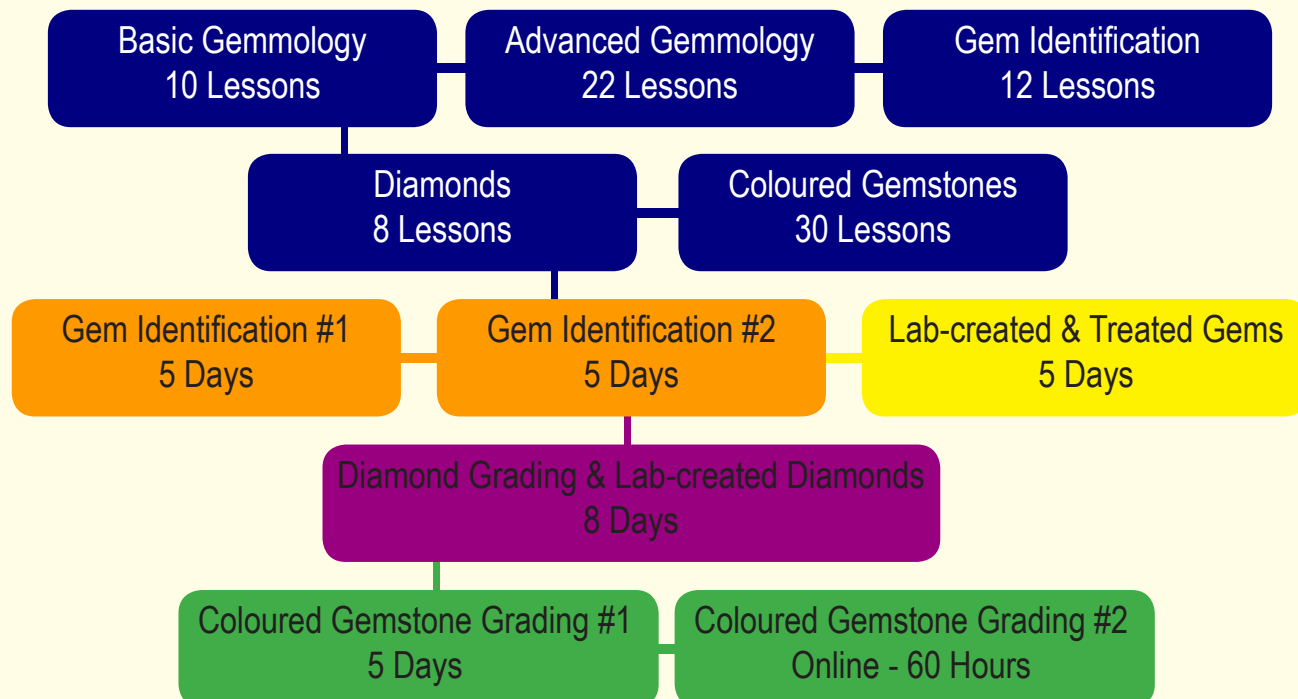


Career Gemmology Seven

Digital Fees

Course Name	Euros	Pounds Sterling	USD
Career Gemmology (Theory)	1400	1250	1600
Gem Identification #1	500	450	550
Gem Identification #2	500	450	550
Coloured Gemstone Grading #1	500	450	550
Coloured Gemstone Grading #2	1000	900	1150
Diamond Grading/Lab-created Diamonds	1750	1575	2000
Lab-created & Treated Gems	500	450	550
Examinations Fees (Final Exam)	250	225	280
Total Cost	6400	5750	7230

GEMMOLOGY ELEVEN PROGRAM



Career Gemmology Eleven

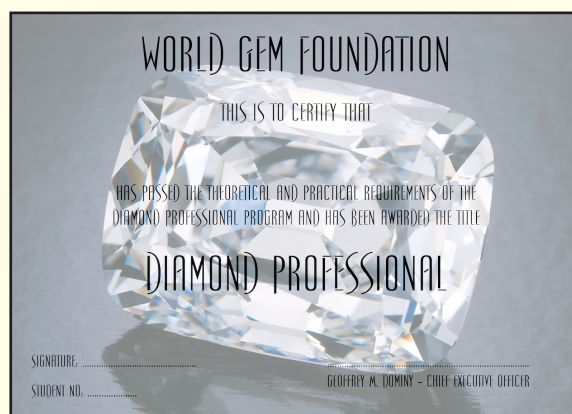
Digital Fees

Course Name	Euros	Pounds Sterling	USD
Basic Gemmology (Theory)	200	180	225
Advanced Gemmology (Theory)	400	360	450
Gem Identification (Theory)	225	200	250
Diamonds (Theory)	225	200	250
Coloured Gemstones (Theory)	500	450	550
Gem Identification #1	500	450	550
Gem Identification #2	500	450	550
Coloured Gemstone Grading #1	500	450	550
Coloured Gemstone Grading #2	1000	900	1150
Diamond Grading/Lab-created Diamonds	1750	1575	2000
Lab-created & Treated Gems	500	450	550
Examinations Fees (Final Exam)	250	225	280
Total Cost	6550	5890	7355

DIAMOND PROFESSIONAL

Diamonds
Theory
8 Lessons

Diamond Grading & Lab-created Diamonds
Practical Workshop
8 Days

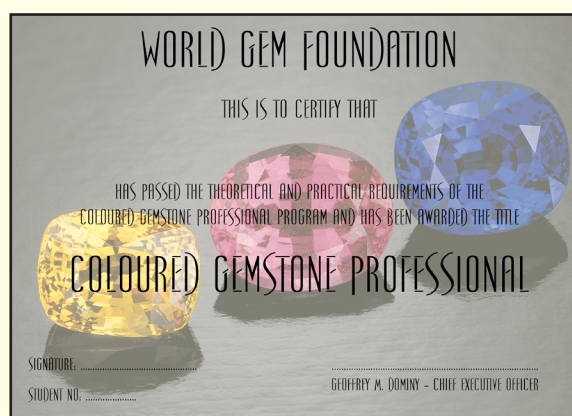
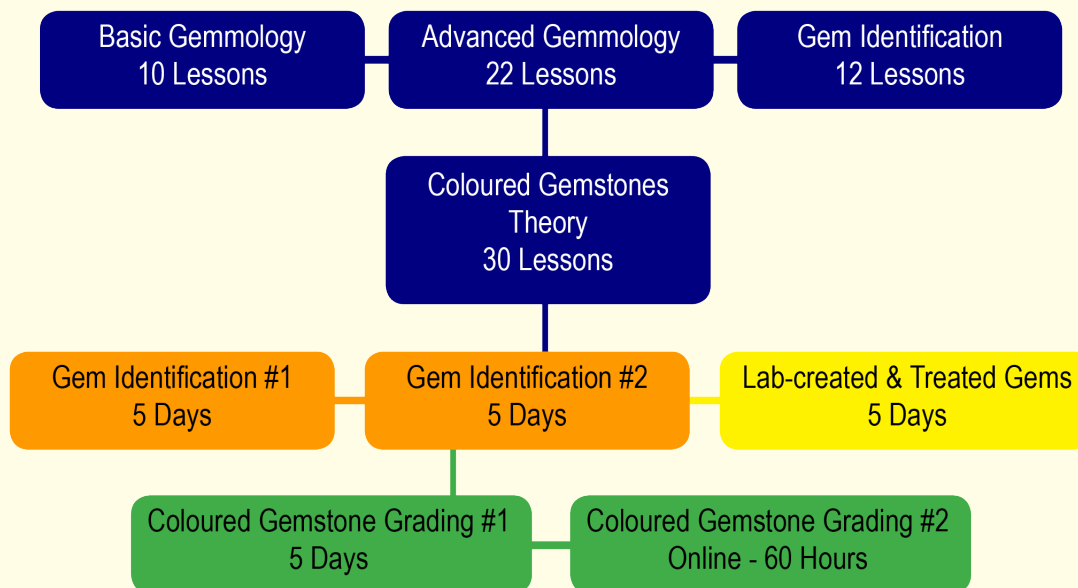


Diamond Professional

Digital Fees

Course Name	Euros	Pounds Sterling	USD
Diamonds (Theory)	225	200	250
Diamond Grading/Lab-created Diamonds	1750	1575	2000
Examinations Fees (Final Exam)	250	225	280
Total Cost	2225	2000	2530

COLOURED GEMSTONE PROFESSIONAL

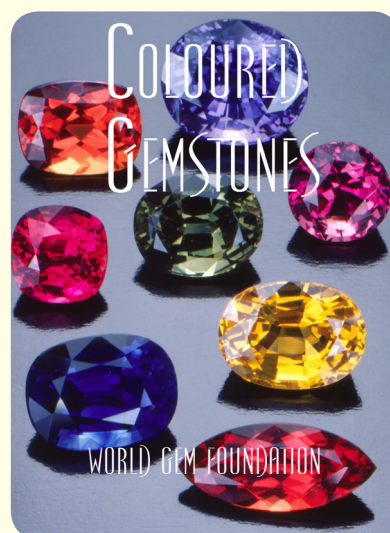
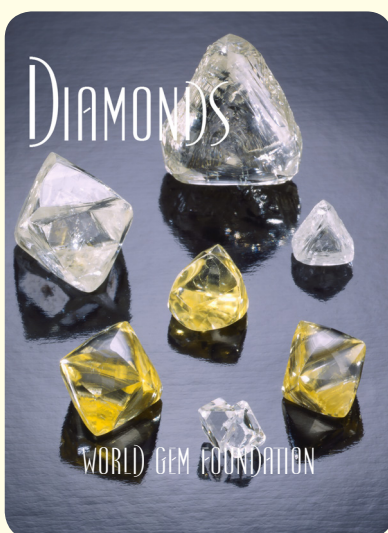
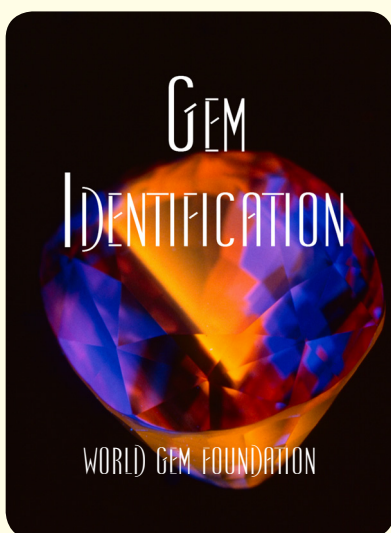
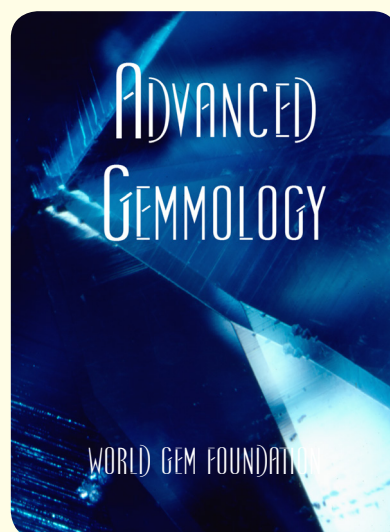
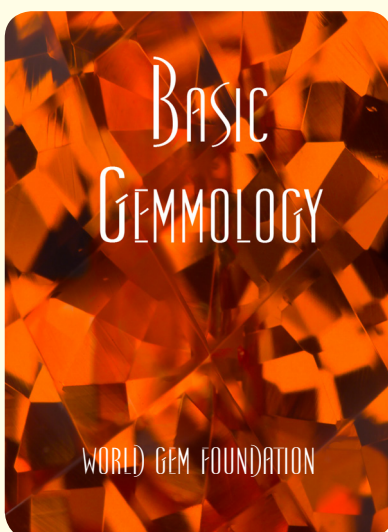
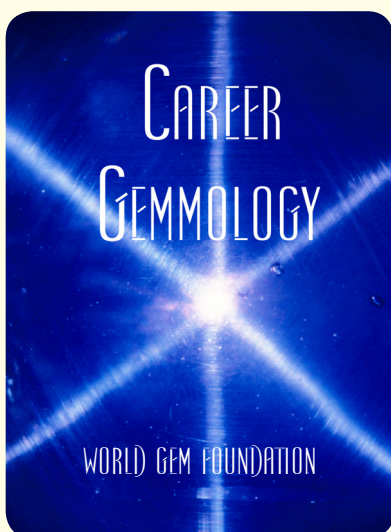


Coloured Gemstone Professional

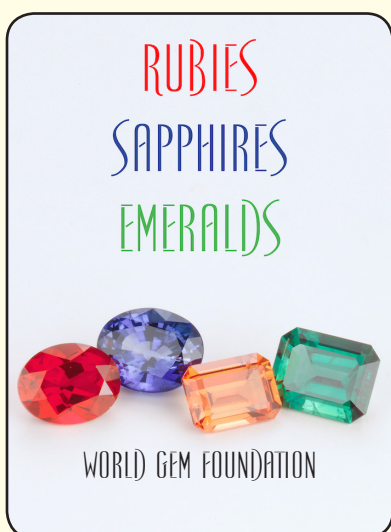
Digital Fees

Course Name	Euros	Pounds Sterling	USD
Basic Gemmology (Theory)	200	180	225
Advanced Gemmology (Theory)	400	360	450
Gem Identification (Theory)	225	200	250
Coloured Gemstones (Theory)	500	450	550
Gem Identification #1	500	450	550
Gem Identification #2	500	450	550
Coloured Gemstone Grading #1	500	450	550
Coloured Gemstone Grading #2	1000	900	1150
Lab-created & Treated Gems	500	450	550
Examinations Fees (Final Exam)	250	225	280
Total Cost	4575	4115	5105

Diploma Courses



General Interest Courses

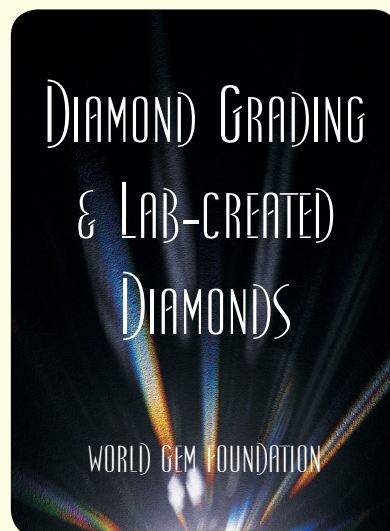
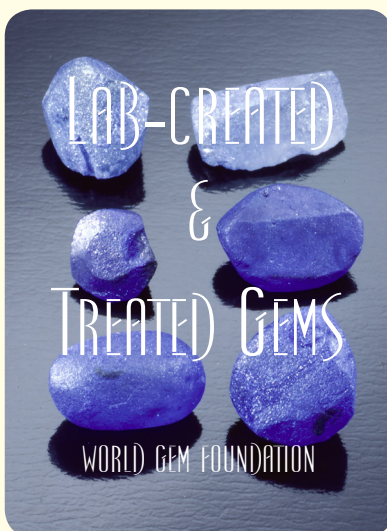
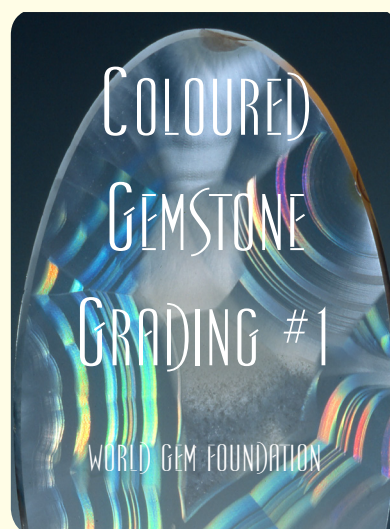
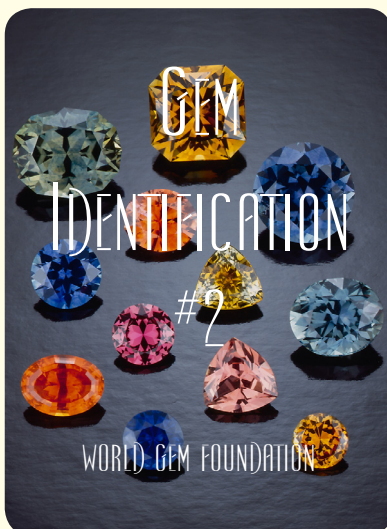
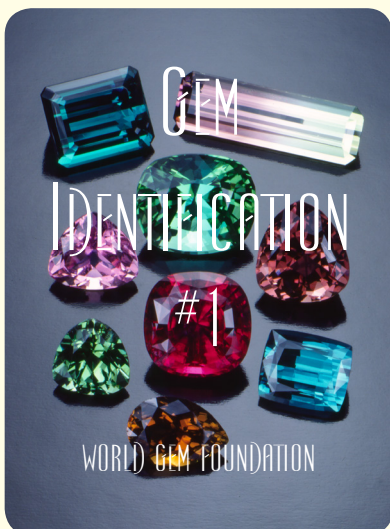


To learn more about our Diploma and General Interest courses, please click on the course icons above.

All of our diploma courses are available in English, Spanish & French.

Currently Rubies, Sapphires & Emeralds, Opals & Jade and Organic Gems are available in English & French.

Practical Workshops



To learn more about our practical workshops, please click on the course icons above



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At the World Gem Foundation, we appreciate that the science of gemmology is constantly evolving. While your knowledge in certain areas may be relevant today, it may be obsolete tomorrow.

To meet this challenge, the World Gem Foundation has introduced our 'One a Student, Always a Student' policy, an innovative program that is unique to the World Gem Foundation and our affiliated gem academies.

Once you register for one of our courses or programs, we provide you with lifetime access to your student page so that every two years when we update our courses, you will receive the latest digital course notes free of charge.

This is one more reason to choose the World Gem Foundation, because to us, you should never stop learning!



Grade School

Imagine you are a jeweller in New York looking for a blue sapphire for a client. You contact one of your wholesale gem dealers and he says 'I have two 2-carat sapphires, one is a G2B colour and the other is a P1B'. What would you do?

Speaking the Same Language - Coloured Gemstones (Part One)

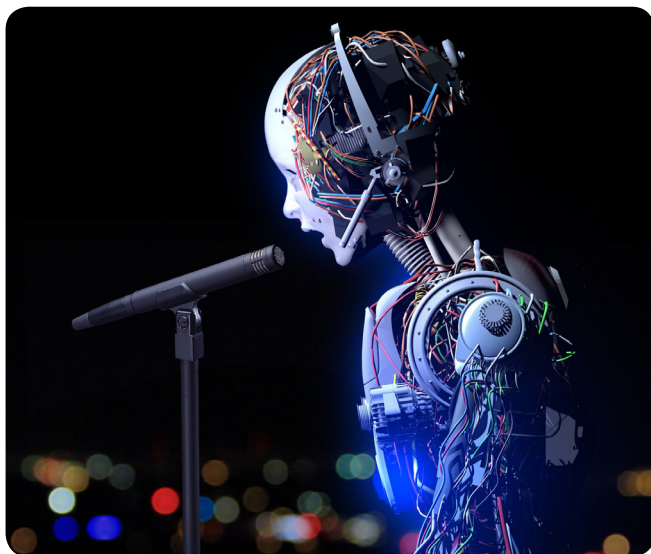


Photo Courtesy of Mouser Electronics

Imagine you are a jeweller in New York looking for a blue sapphire for a client. You contact one of your wholesale gem dealers and he says 'I have two 2-carat sapphires, one is a G2B colour and the other is a P1B'. What would you do? What if he added that the G2B sapphire had a 40 zone and a 30% mask and the P1B had a similar zone but no colour mask? Would you know what he meant? Would you feel comfortable buying the stones?

What about a diamond dealer who tells you he has a certified AGS diamond weighing 1.10 carats, colour 2, clarity 3 and an 'Ideal' cut.

It is a little like the Enigma Code that Turing and his fellow code-breakers broke at Bletchley Park during World War II. If you have the 'key', it all makes sense but if you don't, well that is another question.

Of course if the wholesale gem dealer qualified his comments by saying he used the GemDialogue Colour Grading System and you also owned said system, you would have some idea what he was talking about.

In the first part of 'Speaking the Same Language', we are going to look at the complexities of coloured gemstone grading, the systems currently available in the market place and the descriptive language they use to define colour, clarity and cut. In Part Two (June 2021 issue), we will look at diamonds (colour, clarity and cut) and why one Man's VVS-1 could well be another Man's clarity grade '1'.

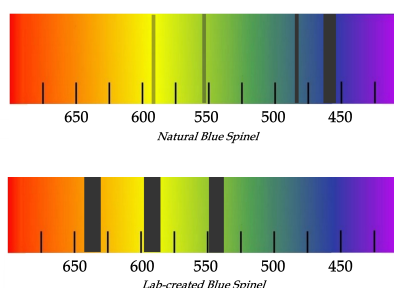
However before we start, let's do a quick review of colour and what it really is.

What is Colour?

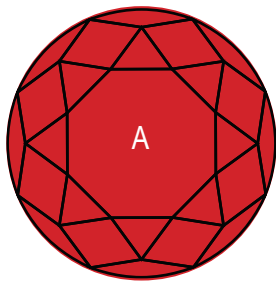
When we view a transparent gemstone in white light, the colour we actually see is the resultant combination of the colours or wavelengths that freely pass through the stone and have not been absorbed.

In the case of transparent stones, absorption occurs as the light passes through the stone; while in opaque stones, absorption occurs as the light is reflected from the surface of the stone. If there is no absorption of light, the gemstone will appear white or colourless, if there is total absorption of light, the gemstone will appear black.

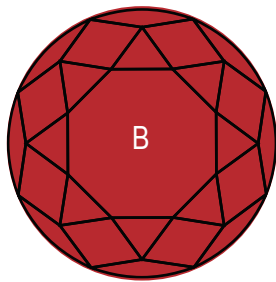
In gemmology we can see this using a spectroscope (diffraction or prism-type) with the areas of the spectrum absorbed by the gemstone appearing as dark lines.



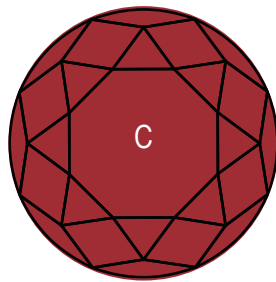
Computer generated absorption spectra showing differences between natural and lab-created blue spinel



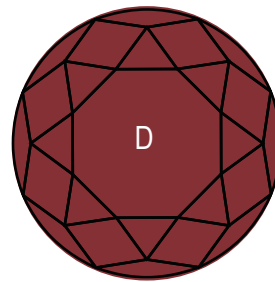
C = 15 M = 100 Y = 100 K = 0



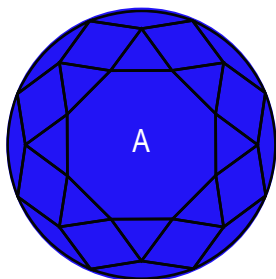
C = 30 M = 100 Y = 100 K = 0



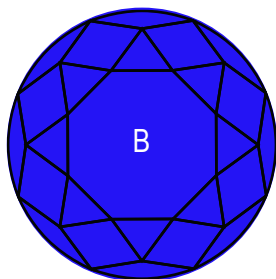
C = 45 M = 100 Y = 100 K = 0



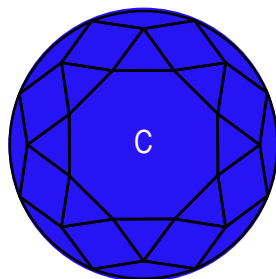
C = 60 M = 100 Y = 100 K = 0



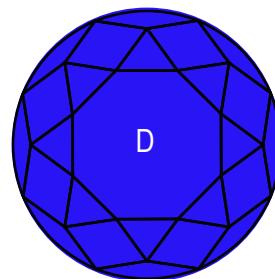
R = 34 G = 20 B = 245



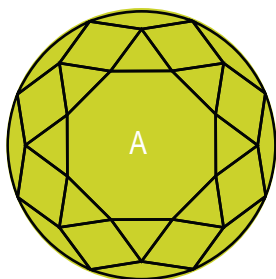
R = 36 G = 20 B = 245



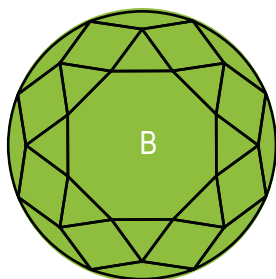
R = 38 G = 20 B = 245



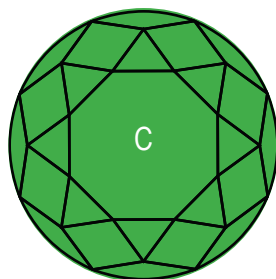
R = 40 G = 20 B = 245



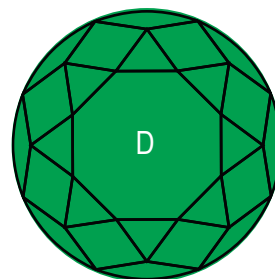
C = 25 M = 5 Y = 100 K = 0



C = 50 M = 5 Y = 100 K = 0



C = 75 M = 5 Y = 100 K = 0



C = 100 M = 5 Y = 100 K = 0

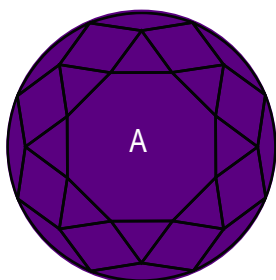
The gem diagrams above are based on either the RGB or CMYK colour modes. RGB stands for Red, Green and Blue while CMYK stands for Cyan, Magenta, Yellow and Black. Both RGB and CMYK are modes for mixing colour in graphic design. As a quick reference, the RGB colour mode is best for digital work, while CMYK is used for print products.

In the first example (CMYK Colour Mode), Cyan has been changed in increments of 15 from 15 to 30 to 45 and finally to 60. Magenta, Yellow and Black have remained unchanged. You can clearly see the difference.

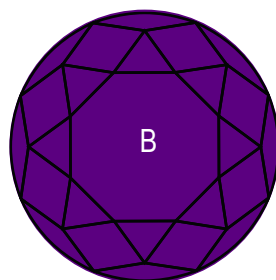
In the second example (RGB Colour Mode), Red has been changed but in this case the increments (2) are much smaller from 34 to 36 to 38 and finally to 40. Green and Blue have remained unchanged. You can see that it is much harder to differentiate between the four colours.

In the third example (CMYK Colour Mode), Cyan has been changed in much larger increments (25) from 25 to 50 to 75 and finally to 100. Magenta, Yellow and Black have remained unchanged. Here we can really see the difference in the four colours.

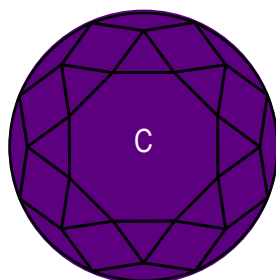
In reality, every time we change a variable by 1, by definition, we are creating a new colour. However as you can see from the example below, when we adjust RED by 1, using the RGB mode, it is impossible for the human eye to detect the difference.



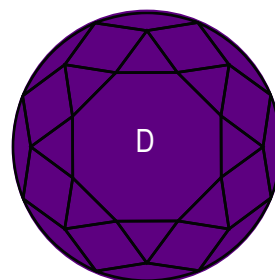
R = 90 G = 0 B = 128



R = 91 G = 0 B = 128



R = 92 G = 0 B = 128



R = 93 G = 0 B = 128



Fluorite (Photo by Tino Hammid)



Yellow Sapphire (92 carats) (Photo by Tino Hammid)



Colour Change Garnet (Daylight) (Photo by Tino Hammid)



Colour Change Garnet (Incandescent Light) (Photo by Tino Hammid)



Colombian Emerald (Photo by Tino Hammid)

In reality, our perception of the actual colour results from our biological visual system's interpretation of the combination of colours or wavelengths from the stone in its lighting conditions.

While there is some debate as to how many different hues the human brain can identify and whether or not women possess the ability to discern more hues than men, we do know that the number of discernible hues is well into the thousands.

The suppression of certain wavelengths or colours in white light is called selective absorption and may be caused by chemical elements (in the form of impurities) present in the gemstone lattice (i.e. chromium III in ruby or iron in amethyst) or by elements, which are intrinsic to the stone's chemical composition (i.e. copper in malachite or manganese in rhodonite).

Based on this, all gemstones can be classified as either:

Allochromatic Gemstones: gemstones where their colour is caused by impurities.

Idiochromatic Gemstones: gemstones that owe their colour to elements present in their chemical composition.

The light source a coloured gemstone is viewed under is critical. If for example, we view it under a 5000 to 5500K (Neutral) light source, all colours will appear at their best allowing for slight variances in hue and/or saturation to be detected. However if we were to view a stone under a light source in the 2900K to 3200K ranges, reds would become less purple and show more orange, oranges would become less yellow and greens, blues and purples would become darker.

Therefore, unless we are viewing a coloured gemstone under the same lighting conditions, your perception of the colour will differ to mine even though we are looking at the identical gemstone.

For grading purposes, coloured gemstones are graded and priced based on the 4 C's (colour, clarity, cut and carat weight) however unlike diamonds, the colour and clarity grading of coloured gemstones is far more complex. Why?

Well for starters, unlike a colourless diamond, colourless gemstones come in a multitude of colours. Secondly, coloured gemstones form under a wide variety of geological conditions. Often it is not only the rate of crystallization that determines whether or not the resulting crystal will form with or without inclusions but also the environment in which it forms. To account for these differences the Gemological Institute of America (GIA) has created a classification system that categorizes gemstones into three types, namely type 1, type 2 and type 3 based on the number of inclusions

typically found in these gemstones. This means that in the case of an emerald, we are far more tolerant of inclusions than a blue topaz. In reality, this classification system levels the playing field.

Colour Grading Systems

Over the years a host of colour grading systems have come and gone. In 1978, Cap Beasley introduced Color/Scan. A year later the Gemological Institute of America unveiled their ColorMaster using the Munsell system of colour description. In 1991, Ken Roberts invented GemSet. In 1994 Thomas Tashey Jr. of the European Gemological Laboratory (EGL) published 'The World of Color', a pocket-sized book based on the Munsell Color System and arranged by tone rather than hue.

Today, four systems stand out, not only for their longevity (GemDialogue was introduced in 1983 by Howard Rubin), but also for their re-invention (The World of Color was re-introduced in 2015) or their ingenuity (Gemewizard was unveiled after eleven years of research and development and is a digital program that is based on the Gemological Institute of America's system).

In this article, we are going to focus on the four systems because of their relevance today.

Colour

Unlike diamonds, where a lack of colour (unless we are dealing with fancy coloured diamonds), high optical purity and brilliance are highly sort after, coloured gemstones are prized for their richness and purity of colour with most people agreeing that colour is worth as much as 70% of the overall value.

Since even slight variations in colour can have a huge impact on the overall value, correctly assessing the colour is of paramount importance.

While there is a consensus of how important colour is to the overall value of a coloured gemstone, each system uses different terminology to describe the lightness of a hue and the departure degree of a colour from the neutral colour of the same lightness or darkness.

System	Colour Attribute	Lightness/Darkness	Colour Intensity
GIA	Hue	Tone	Saturation
Gemewizard	Hue	Tone	Saturation
GemDialogue	Hue	Colour Mask	Zone
World of Color	Hue	Tone/Value	Saturation/Chroma

Hue

Hue refers to the position of a colour on the colour wheel. GIA, Gemewizard, GemDialogue and 'The World of Color' all refer to colour as hue, however GIA and Gemewizard include thirty-one (31) basic colours in their systems, the GemDialogue Spectral Circle uses forty-five of which twenty-one (21) are included in their binder 'Color Comparison Charts' and are printed on transparent detachable pages, while the 'The World of Color' uses forty.

So if GIA or Gemewizard were used to colour grade a ruby, one could expect terms such as RED(R), orangey Red (oR), Red-Orange or Orange-Red (RO or OR) or reddish Orange (rO). It could also be described as Red-Purple or Purple-Red (RP/PR), strongly purplish Red (stpR) or slightly purplish Red (slpR).

The primary hue is described by using a 'Capital' letter (Red) while the secondary hues are described in lower case (purplish).

With GemDialogue, the same ruby could be described as Red (R), Slightly Orange Red (O1R), moderate Orangy Red (O2R) or Strong Orangy Red (O3R). It could also be described as Strong Purplish Red (P3R), Moderate Purplish Red (P2R) or Slightly Purplish Red (P1R).

If we were using 'The World of Color', we might find ourselves using terms such as Pale Pink to Very Deep Red to Vivid Red (2.5R), Pale Pink to Very Deep Red to Vivid Red (5R) or Pale Orangy Pink to Very Deep Red to Vivid Orangy Red to Vivid Red (7.5R). It could also be described as Pale Purplish Pink to Very Deep Purple Red to Vivid Purple Red (5RP), Pale Purplish Pink to Very Deep Purplish Red to Vivid Purplish Red (7.5RP) or Pale Pink to Very Deep Purplish Red to Vivid Purplish Red (10RP).

With Gemewizard, the computer interface offers all thirty-one choices, calibrated to the GIA colour table, arranged in a square and available in the variety of common shapes and styles of cut. One simply chooses the master hue that is closest in colour.

With GemDialogue, the user matches the stone with any one of the twenty-one main hues that are contained in the binder 'Color Comparison Charts' or can create a multitude of other colour possibilities by combining transparencies until a suitable match has been found.

Users of 'The World of Color' select the colour page that represents the closest colour match to the sample being graded and isolate the specific colour sample with the quartz gem crown that is supplied with the system.

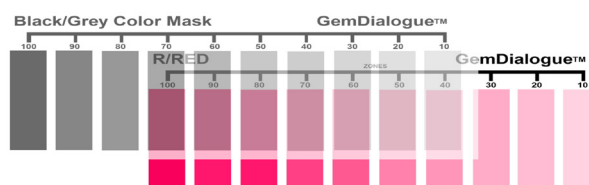
Tone, Value or Colour Mask

This refers to the degree of lightness or darkness of a colour. GIA, Gemewizard use the term 'tone', 'The World of Color' use both 'tone' and 'value' while GemDialogue uses the term 'colour mask'. As we can see from illustration on the opposing page, the effects tone/value or mask can have on a hue are quite substantial. In this illustration, only the tone has changed. The hue and saturation are the same.

GIA use ten different categories with 0 being the lightest and 10 being the darkest, while the Gemewizard system use seven. GemDialogue uses two transparent colour masks (black/grey or brown/light brown) ranging from 10% to 100% while 'The World of Color' uses a tonal scale that is the reverse of the GIA and Gemewizard systems with 0 representing the darkest tone/value and 10 representing the lightest tone/ value.

Once a suitable master hue from the Gemewizard interface has been chosen, the user clicks on the colour sample. Seven tonal options, all relating to the master hue will appear to the right of the images. This allows the user to see how the various tonal differences influence and affect the overall colour of the master hue.

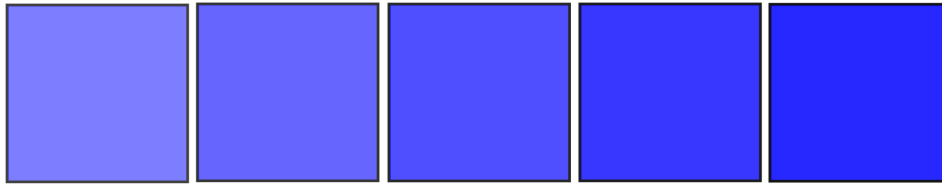
With GemDialogue, the user selects either the black/grey or brown/light brown transparent colour mask and places it over the main colour hue transparency. By sliding the transparent overlay either to the left or the right, the user can adjust the tone of any of the colour samples until a suitable match has been found.



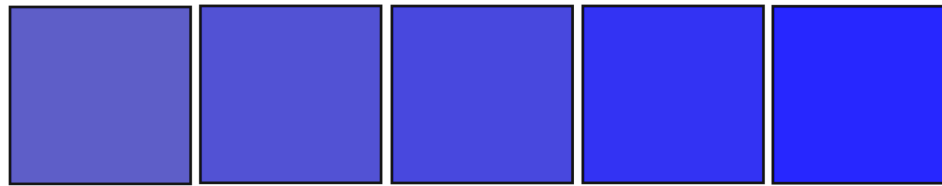
'World of Color' users select the colour sample that has the closest tonal match to the sample being graded with the lightest tones at the top of each page and the darkest tones at the bottom.

Saturation, Chroma or Zone

This refers to the intensity of a colour. The images on the opposing page show various levels of saturation from least vivid (left) to most vivid (right). It is important to note that of the three variables (hue, tone and saturation), only the saturation levels have been changed.



Illustrating the tonal changes in the same hue from lighter (far left) to darker (far right)



Illustrating the various changes in saturation from less vivid (far left) to vivid (far right)

GIA and Gemewizard use six different levels from 1 (greyish or brownish) to 6 (vivid). These include Greyish (cool) or Brownish (warm) (1), Slightly greyish (cool) or Slightly brownish (warm) (2), Very slight greyish (cool) or Very slight brownish (warm) (3), Moderately strong (4), Strong (5) and Vivid (6).

‘Cool’ refers to colours that are blue, green, violet, or purple while ‘Warm’ refers to colours that are red, orange or yellow.

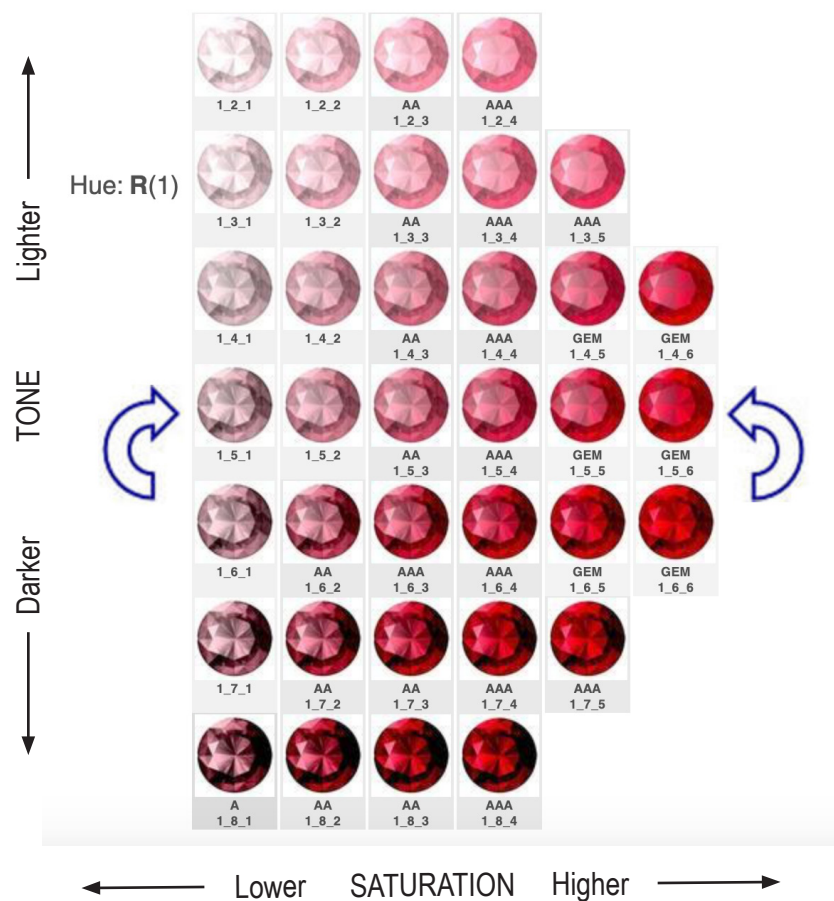
GemDialogue use ten zones from 10 to 100.

‘The World of Color’ uses a scale from 0 to 18.

At the same time the tonal options appear on the right hand side of the Gemewizard screen, six saturation options will appear along the bottom. If the user is still unable to find a suitable match, he may double click on the closest match and an intelligent browser will provide anywhere from 36 to 40 alternative choices in varying levels of tone and saturation.

With GemDialogue, each of the twenty-one transparent overlays provides ten zones (saturation levels). These show how the various saturation levels affect the overall hue.

‘The World of Color’ is similar to GemDialogue with the various saturation/chroma colour samples extending from left (low saturation) to right (high saturation) on each colour page.



Gemewizard interface showing tonal and saturation options

Final Colour Grades

Using the GIA and Gemewizard colour grading systems, a stone with a rP 6/4 notation would be described as reddish Purple (with purple being the primary hue), medium dark tone (6) and a moderately strong saturation (4).

The same stone graded using GemDialogue according to the GemDialogue Color ToolBox Cross-reference Guide ©, would be described as R2P (moderate reddish Purple), with a zone of 60 and a 50% grey colour mask.

An extra fine quality emerald graded using 'The World of Color' with an assigned hue of 5G, a tone/value of 5 and a saturation/chroma of 14 would be described as 5G 5/14 or using the transparent overlay as 'Vivid Green'.

What is the Best Colour?

GIA, Gemewizard, GemDialogue and 'The World of Color' all list what they believe are the ideal hues, tones/values/colour masks and saturations/chroma/zones for coloured gemstones. These are based largely on market demand and availability.

The chart below shows what each system 'considers' to be the 'best' colours for the rubies, blue sapphires and emeralds. It is interesting to note that with GIA and Gemewizard, a fine quality emerald will have a bluish/GREEN hue while with GemDialogue it could range from slight Yellowish Green to Green to slight Bluish Green while with 'The World of Color', they prefer GREEN with no secondary hues. Confused?

In the next issue (June 2021) we will continue to look at how each system describes 'clarity' and 'cut' in coloured gemstones, where they agree and where they differ.

Gemological Institute of America & Gemewizard™

Gemstone	Hue	Tone	Saturation
Ruby	RED	6	6
Blue Sapphire	violet/BLUE or BLUE	6	6
Emerald	bluish/GREEN	5	5

GemDialogue™

Gemstone	Hue	Zone	Colour Mask
Ruby	RED or MAGENTA	100 or 90	0
Blue Sapphire	P3B	100	0
Emerald	Y1G, G or B1G	100 or 90	0

World of Color™

Gemstone	Hue	Tone/Value	Saturation/Chroma
Ruby	10RP	4	14/16
Blue Sapphire	5PB	4	14
Emerald	5G	4/5	12/14

Clarity

Earlier in the article we talked out gemstones forming in different geological formations. Some are the produces of rapid cooling while others are the products of slower cooling.

If a gemstone is the product of rapid cooling, invariably this will lead to more inclusions. If we take an ice cube tray, fill it with water and place it in a very cold freezer, the water will freeze far quicker and the chances of having a crystal clear ice cube will be far less probable. If however we can control the rate of crystallization, it is possible to produce an ice cube that is not full of fractures. Try putting an ice cube tray full of water in your freezer with aluminium foil over it. You will be amazed at the difference compared to simply putting the ice cube tray into the freezer without any covering.

To level the playing field, the Gemological Institute of America (GIA) and Gemewizard classify all coloured gemstones into three types:

Type 1: includes gems that form with relatively few inclusions and have no eye-visible inclusions.

Type 2: includes gems that typically form with some minor inclusions that may be eye-visible.

Type 3: includes gems that form with many inclusions that are usually eye-visible.

Clarity is of particular interest to the lapidary since he knows that any inclusions in a type 1 stone will have a detrimental affect on the value of the finished gem and should be removed wherever possible.

When assessing the clarity grade of a coloured gemstone, we must first identity the stone. Once this has been confirmed, the chart to the right (which includes some of the more common coloured gemstones) can be consulted to see what level of inclusions are deemed acceptable. Again, we will need to access the clarity of the gemstone with the unaided eye first, followed by 10X magnification in a face-up position.

If we look, for example, at GIA's descriptive terms for a 'Slightly Included' gemstone based on type, we can see that if the gemstone is an aquamarine (Type 1), it will appear clean to the unaided eye but may have minute inclusions under 10X. If the gemstone is a blue sapphire (Type 2), it will appear clean to the unaided eye but may have moderate inclusions at 10X. However if we are looking at an emerald (Type 3), it may have minor inclusions visible to the unaided eye with moderate inclusions under 10X.

GIA use five clarity classifications (severely included, heavily included, moderately included, slightly included and eye clean) based on gemstone type.

Gemstone	Type
Aquamarine	1
Emerald	3
Alexandrite	2
All Garnets	2
Peridot	2
Amethyst quartz	2
Ametrine/Citrine quartz	1
Ruby	2
All Sapphires	2
All Spinel	2
All Topaz	1
Bi-Colour/Blue Tourmaline	2
Blue-Green Tourmaline	1
Chrome/Green Tourmaline	1
Golden Tourmaline	2
Pink Tourmaline	2
Red Tourmaline	3
Zircon (all colours)	1
Tanzanite (Zoisite)	1



African Aquamarine (Type 1) (Photo by Tino Hammid)



Blue Sapphire (Type 2) (Photo by Tino Hammid)

GemDialogue require all stones to be clarity graded twice in a face-up position, firstly with the unaided eye and secondly under 10X magnification. This makes allowances for darker stones, where the inclusions may be obscured by the colour mask, and lighter stones, where even slight inclusions may be noticeable. They also make allowances for stones that are normally, seldom or rarely eye clean in their final grading.

So for a gemstone to receive a 'DE' clarity grade with the unaided eye, it would need to have inclusions that are visible but difficult to see with the naked eye, while under 10X, to receive an SI-1 clarity grade, inclusions would be seen easily but are not located in the centre of the stone.

GemDialogue use five clarity classifications when graded using the unaided eye (EC, DE, DE-SE, SE-DE, SE) and eleven under 10X (Flawless, VVS-1, VVS-2, VS-1, VS-2, SI-1, SI-2, I-1, I-2, I-3, I-4).

'The World of Color' recognizes both the Gemological Institute of America (GIA) and the American Gemological Laboratories (AGL) clarity grading system. The latter uses three components to determine the clarity grade of a coloured gemstone, namely inclusions, texture, and zoning.

For inclusions, they have five classifications (free of inclusions, lightly included, moderately included, heavily included and excessively included) with deductions ranging from zero (for gemstones free of inclusions) to minus 2 (for gemstones that are excessively included).

For texture, there are four classifications (transparent or faint, moderate, strong and prominent) with deductions ranging from zero (for transparent/faint) to minus 1.5 (for prominent).

For zoning, there are three classifications (none or slight, somewhat visible and prominent) with deductions ranging from zero to minus 1.

Cut

While traditionally coloured gemstones were often poorly proportioned with more emphasis placed on colour, clarity and weight retention, today there is definitely a trend towards improving the cut with many (like Michael Dyber, Victor Tuzlukov, John Dyer, Glenn Lehrer and the Munsteiner Family to name just a few) taking gem cutting to a whole new level.

The Gemological Institute of America (GIA) classifies coloured gemstones into one of five categories (excellent, very good, good, fair and poor) to evaluate the overall quality of the cut.

This classification system is based on a number of variables including light return (brilliance), light leakage, symmetry, face-up outline, length to width ratios, bulge factor, girdle thickness, table size, polish and facet symmetry.

For a coloured gemstone to receive an 'Excellent' cut grade, it must meet the following criteria:

- Brilliance (light return) of 75% or greater in a face-up position.
- Minute variations in face-up and profile symmetry that do not make the gem less attractive or cause light leakage.
- An attractive face-up outline.
- Length to width ratio that conforms to industry preferences.
- Acceptable bulge, girdle thickness and table size.
- Excellent polish and facet symmetry.

At the low end of the scale, a coloured gemstone will receive a 'Poor' cut grade if:

- Brilliance (light return) less than 25% in a face-up position.
- Face-up outline may not be even or symmetrical.
- Profile might reveal extreme shallowness or depth resulting in very obvious light leakage.
- Poor finish, facets may be unsymmetrical, polish lines and abrasions visible.

GemDialogue uses five cut grades (excellent, very good, good, fair and poor) to assess the proportions and symmetry of a coloured gemstone.

To receive an 'Excellent' cut grade, a coloured gemstone must have:

- Excellent symmetry.
- Facets cut at correct angles.
- Colour and brilliance are at a maximum for the material involved.

To receive a 'Poor' cut grade, a coloured gemstone must have:

- Very poor symmetry and/or proportions.
- Lacks colour uniformity and brilliance.
- Stones are either too deep or too shallow and often off-centre.

They also address cut differently with cutting and polish assessed separately. Users of their system complete a worksheet and make the following allowances for cut:

Cutting/ Symmetry	Excellent	Very Good	Good	Fair	Poor
Cutting	+ 2.0	+ 1.0	0	- 1.0	- 2.0
Polish	0	- 0.25	- 0.50	- 0.75	- 1.0

'The World of Color' and GemGuide (both marketed by Gemworld International use three components to assess cut: light performance, proportions and finish.

Light Performance

Light performance is based on brilliance, windowing and extinction with a judgement made as to what percentage of each trait the gemstone exhibits. When establishing the full overall cut analysis however, they only use the brilliance percentage. If the texture is strong or prominent, they do not grade for light performance since this has already been accounted for under texture.

Deductions range from zero if the brilliance is between 75% and 100% to minus 1.5 if the brilliance is between 5 to 35%.

Proportions

Proportions are judged visually and include the crown height, the pavilion depth, the bulge factor, girdle and the table size with deductions ranging from zero to minus 0.5 and

symmetry where the deduction can be as high as minus 1.5 if it is deemed to be poor.

Finish

Finish assesses the overall polish and symmetry of the facets with deductions only occurring if it is deemed fair (minus 0.5) or poor (minus 1.0).

Overall Grade

To arrive at a final grade using GemGuide, the user takes the colour score assigned using the 'World of Color' Colour Grading system and subtracts the various deductions for clarity and cut to arrive at a final score.

Closing thoughts.....

Organizing your thoughts and putting them down on paper can be an enlightening experience. It can also bring clarity (no pun intended) to a situation.

Sadly we work in an industry where a lack of consensus regarding the grading of coloured gemstones has created a confusing landscape, where our ability to communicate effectively has been stymied by systems that only work when both people use them and are familiar with them.

I saw a sign the other day that said 'A smile is the same in any language'. Perhaps this should be true of coloured gemstone grading. It's just a thought!



Tourmaline (26.10cts) (Vigoff collection) cut by Victor Tuzlukov (Photo by Dmitry Stolyarevich)



Objective Diamond Clarity Grading

Michael D. Cowing

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

What People are Saying:

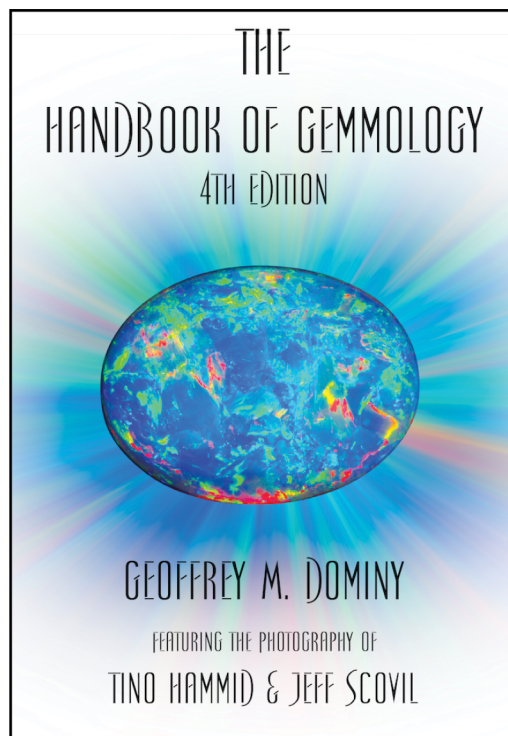
'Leave it to Michael to grab on to the math of the 'Golden Spiral' and doggedly work it until he could present a mathematical method for consistent clarity grading'. Gary Roskin - Executive Director of ICA

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

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The World Gem Foundation is delighted to offer five more scholarships this year. These scholarships cover the theoretical components of our Career Gemmology Diploma Program and 50% of the practical workshops and examinations.

Tino Hammid Memorial Gemmological Scholarship



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

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

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

In 2022, the World Gem Foundation will award five scholarships allowing deserving students to take the World Gem Foundation theoretical 'Career Gemmology' course.

The deadline for submitting your application is December 31st, 2021. All applications will be judged by Tino's wife Petra and his oldest daughter Evelyn with the mandate to select those five candidates who, in their opinion, best epitomize the spirit of Tino.

Each recipient will also automatically receive a second scholarship (W.E. Hunn Memorial Gemmological Scholarship) that will provide funding of up to 50% of the cost of the practical workshops and final examinations.

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



Scholarship Recipients 2021

We would like to thank all those who submitted applications for the 2021 Tino Hammid Memorial Gemmological Scholarship. This year we awarded five scholarships, from a variety of backgrounds and different parts of the world but all sharing an enthusiasm and passion for gemmology. Each successful applicant will now be enrolled in the World Gem Foundation's Career Gemmology (Theoretical) Course and will also be automatically eligible for the W.E.Hunn Memorial Gemmological Scholarship that will provide funding of up to 50% of the cost of the practical workshops and final examinations. We wish them all the best of luck.



Abdel Issa (Central African Republic) is 19 years old and of Central African nationality. He has resided as a refugee on Cameroonian territory since 2014 with his family following the political crisis of 2013. His is single without children and the eldest of six children. He had his baccalaureate exam in science this year and is very keen on becoming a gemmologist. He started looking for a gemmological scholarship, since his current financial situation made studying impossible.



Edmont Pasipamire (South Africa) has the mental alacrity to grapple and solve intellectual or academic issues. He has the psychological resilience to withstand pressure with regards to academic work. His highest qualification is a Bachelor of Science in Psychology. He has also undertaken and successfully completed other Diploma courses in Information Science. He is an avid reader of books and this has given him an advantage in terms of broadening his mind. His desire is to start a business as a diamond wholesaler which is why he applied for the Tino Hammid Memorial Gemmological Scholarship.



Moffat Gudo (Zimbabwe) is a seasoned and motivated diamond specialist, specializing in gem identification and their evaluation. He enjoys bringing value to his clients and fostering concrete togetherness with his co-workers. As a Diamond Quality Manager since 2015, he has been the entity's 'diamond intellectual' focal point in rough and polished diamond evaluation, sorting and polishing departments. In 2015, he graduated from the Diamond Education College with a Diploma in Rough Diamond Evaluation, then a Diploma in Diamond Cutting and Polishing from the Harry Oppenheimer Diamond School where he was nominated as the best student. In 2020, he added the GIA Graduate Diamonds Diploma and GIA Applied Jewelry Professional Diploma to his accomplishments.



Mogogi Tirelo (Botswana) is an accomplished sales executive at a National organisation called Botswana Postal Services. He has a Level 5 Diploma in computing from a local private institution and enjoys using his skills to contribute to the exciting technological advances that help in adding value to the services they provide. He enjoys reading books especially those that captivate and open his mind to new developments in his fields of interest. He also enjoys reading the bible and going to church. He has always been fascinated, since a tender age, by gemstones especially diamonds and anything that shines and sparkles. He also enjoys sports, mostly football (soccer), basketball and boxing, all at national and international levels.



Rasul Rajabov (Czech Republic) got the chance to study jewelry making three years ago and decided to dedicate himself to this beautiful craft. In the process of learning, he has got to know many great people around the world who share his passion. His friend and fellow scholarship recipient (2020) Alexey Tuez advised him that jewelers should not only be knowledgeable in metals but also in precious stones. He started his research in this topic and suddenly discovered a whole new, beautiful world of precious gems! The science captured him completely. He started his studies and managed to obtain such titles as Certified Pearl Specialist (CPAA), GIA Applied Jewelry Professional, GIA Diamond Grader and Jewelry Consultant (HRD Antwerp). His lifetime goal is to become a skilled and professional gemstone-specialist as well as a jeweler. In striving to improve his knowledge, he discovered the Tino Hammid Memorial Gemmological Scholarship.

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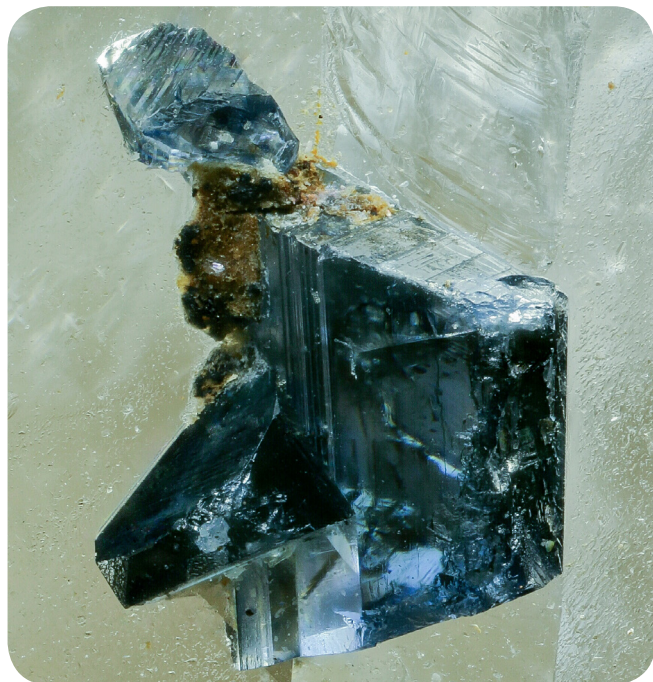
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Out of this World

In this issue, NINA ZOLOTUKHINA recalls how her grandmother's button box, a kind biology teacher and an old German biological microscope opened her eyes to a 'Secret World' of hidden treasures.



My journey to the Micro World



Anatase crystal in Quartz (Russia) (Photo by Nina Zolotukhina)

My journey into the Micro World started with my Granny's box of buttons. I would sit for hours, looking at every single button, its color, surface, the pattern on it and the inclusions in it! Yes, yes, some of them had inclusions! They were my favorite ones and I remember them in detail: they were made from clear glass, had a round shape, like little glass balls with convex rose flowers surrounded by green leaves inside.

My second experience stemmed from my biology lessons. Biology was one of my most favorite school subjects. It was also where I received my highest marks. My teacher presented me with an old black German biological microscope. I loved to observe the various parts of different plants. I remember that my first 'study' subject was an onion skin, where we needed to use an iodine solution to see its cell structure.

Time passed and I got interested in mineralogy and gemology. The more my interest grew, the more attention I paid not only to the minerals but to their inclusions, colors,

surfaces and shapes. I also wanted to share with others all the magic that I could see under my magnifying glass and through the microscope.

In reality, it took me a lot of time to share what I was seeing. I had spent several years looking and sharing pictures on the Internet before the moment came. One of my friends, who had started to make pictures of minerals and their inclusions himself, told me 'you think more, than you do! Just take your camera and try to make your first shot!'

I started initially by capturing minerals and their inclusions with my magnifying glass and phone. This progressed to a microscope and phone and then to a microscope and a small portable digital camera but I always had the feeling that I was missing something and that I wanted more: more resolution, more sharpness, more magnification, more quality, more of everything!

Once my friend and mineral lover, Pavel Martinov, saw my pictures and understood my aspirations and passion for macro and microphotography, he offered to help. As it turned out, he had been taking macro and microphotographs of minerals and their inclusions for some time and was a well known professional in that sphere! He had even assembled, by himself, a special micro photo device consisting of a DSLR Camera, teleconverter 200mm objective lens and changeable micro objectives. He even offered me his device to try out!

It took me several years to get familiar with his articles about macro and micro capturing and how it all worked. During this time, Pavel fielded an endless stream of questions that needed answers and provided me with a wealth of technical information. He taught me remotely how to use it and thank goodness, I already had some photo experience because this really helped me to understand what he was trying to explain.

After my first successful attempts I was totally involved in the process, often staying up half the night just to get one good shot ready and stacked.

There are a lot of factors that can influence the final image and increase the shooting time. One piece of dust can spoil a whole stack consisting of 200+ pictures as well as slight changes in the light or mineral position, which can force you to start the entire process from the beginning.

In my case, sometimes the light sources and the camera would get overheated and the software would crash because of the number of tasks involved and the time it took to do them. This often forced me to stop working and wait for some time before I could start again.

I tried nearly all my most daring ideas and captured minerals and their inclusions in the size range from less than 0,1mm to 5cm! The device inspired me and allowed me to push the boundaries.

Now I dream of assembling one day, my own device for macro photography and photomicrography and I am sure Pavel will be happy to help me with the technical parts so that I can continue my journey into the Micro World.

During my photographic experience, I have noticed some interesting things. You never know what you will discover on the other side of the objective lens! Sometimes a

promising sample can be absolutely unattractive under high magnification, while a small and ugly piece can surprise you with an inner world that is full of beauty and harmony!

Finding rare and beautiful inclusions does not necessarily have to cost you a fortune. You can always find interesting inclusions in low cost pieces since the more included a gemstone is, the lower the price.

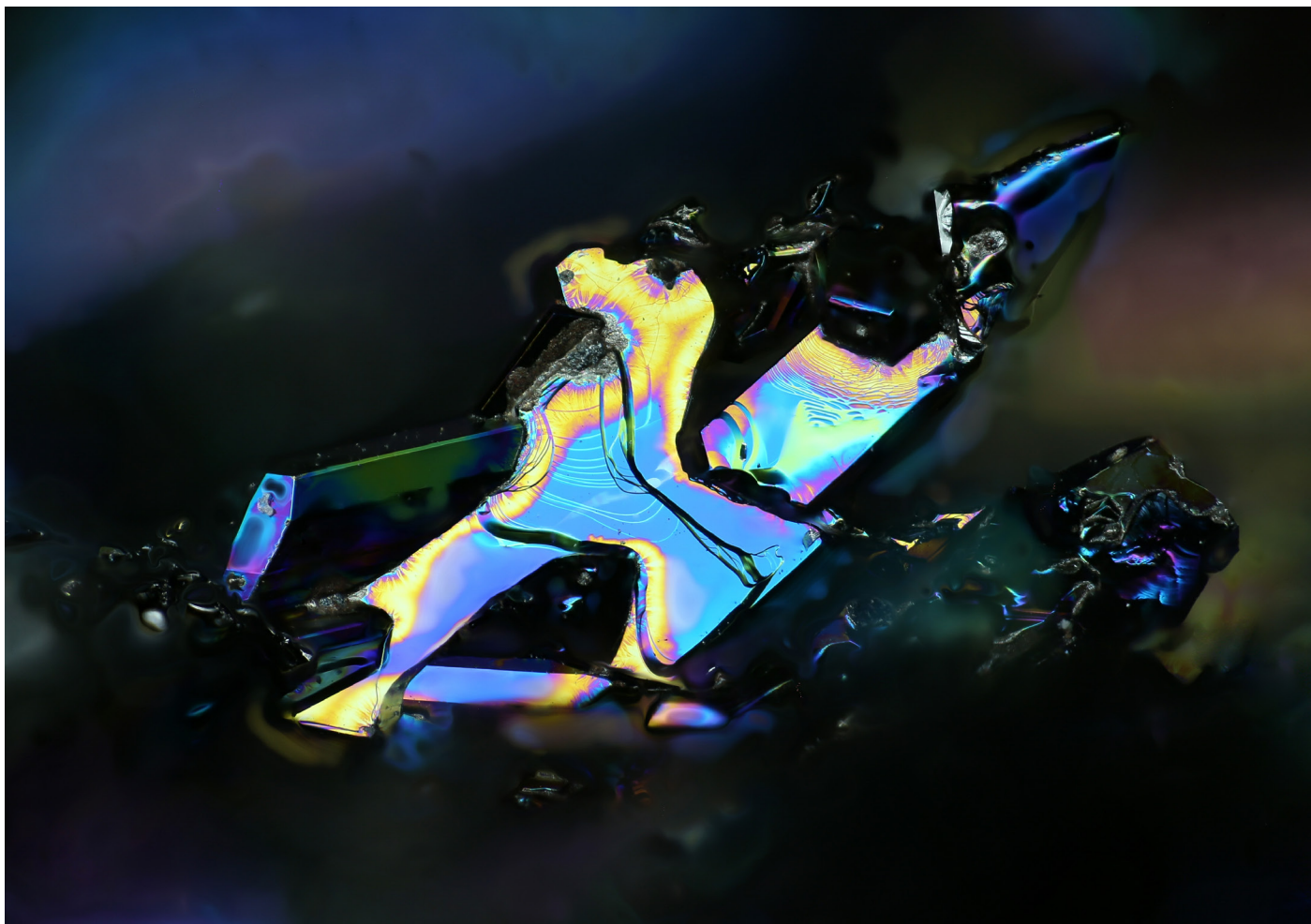
I can guarantee you that once you start your own journey into macro and microphotography, your opinion about your mineral or gemstone collection will definitely change. You will notice things that you never noticed before.

Every single mineral appears as a small 'Micro World' to me. They are all absolutely unique in their nature, character and mood. I always try to find the fine line between science and creating a piece of art. On the one hand I try not to distort the 'real life' appearance of an inclusion or mineral but, on the other hand, I want to show it from an unusual angle and to reveal its uniqueness and beauty.

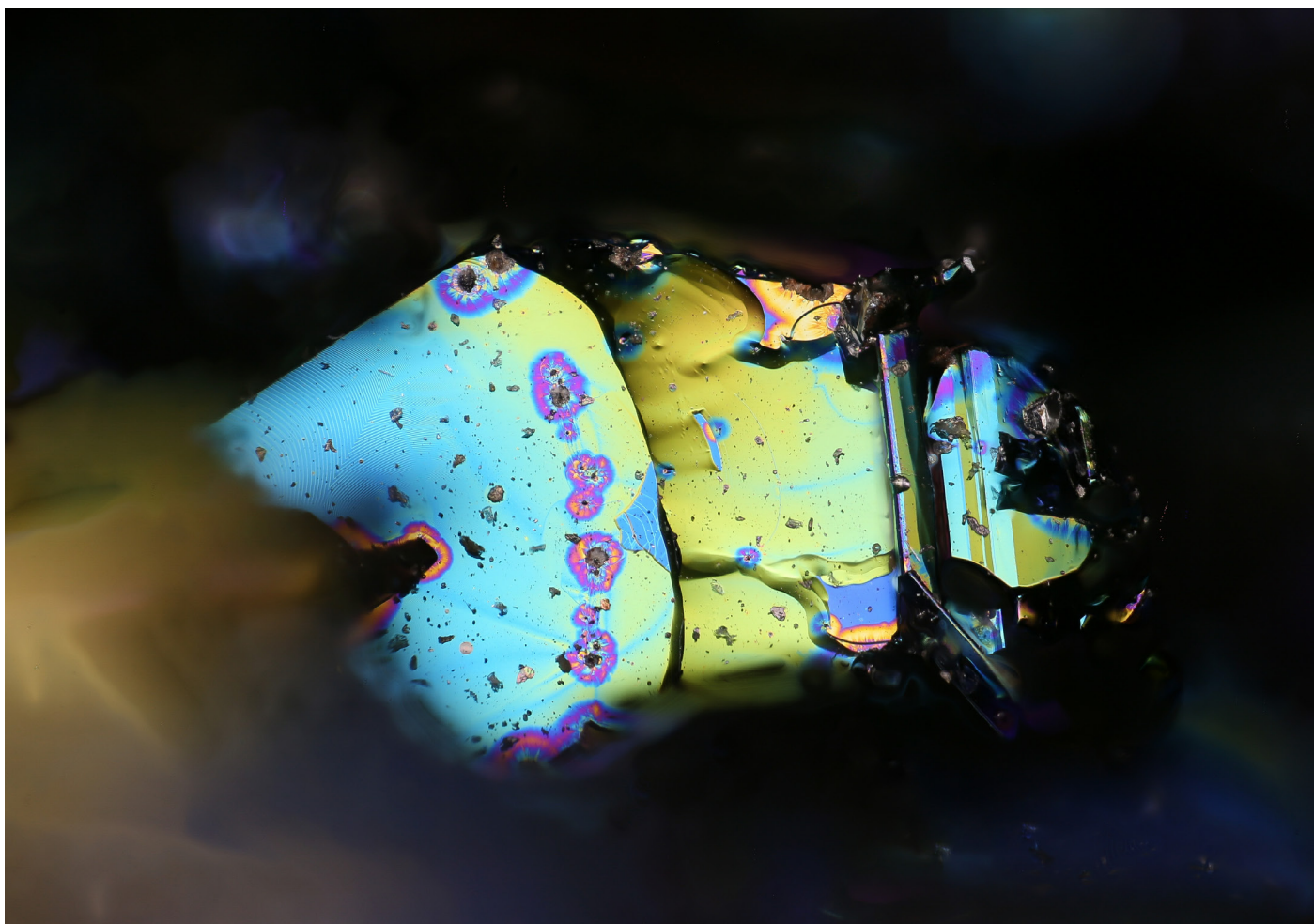
I will leave it up to you to judge from my photos whether or not I have succeeded. I also hope that you will not regret the time spent looking at them because in each photo, there is a tiny piece of my soul inside them.



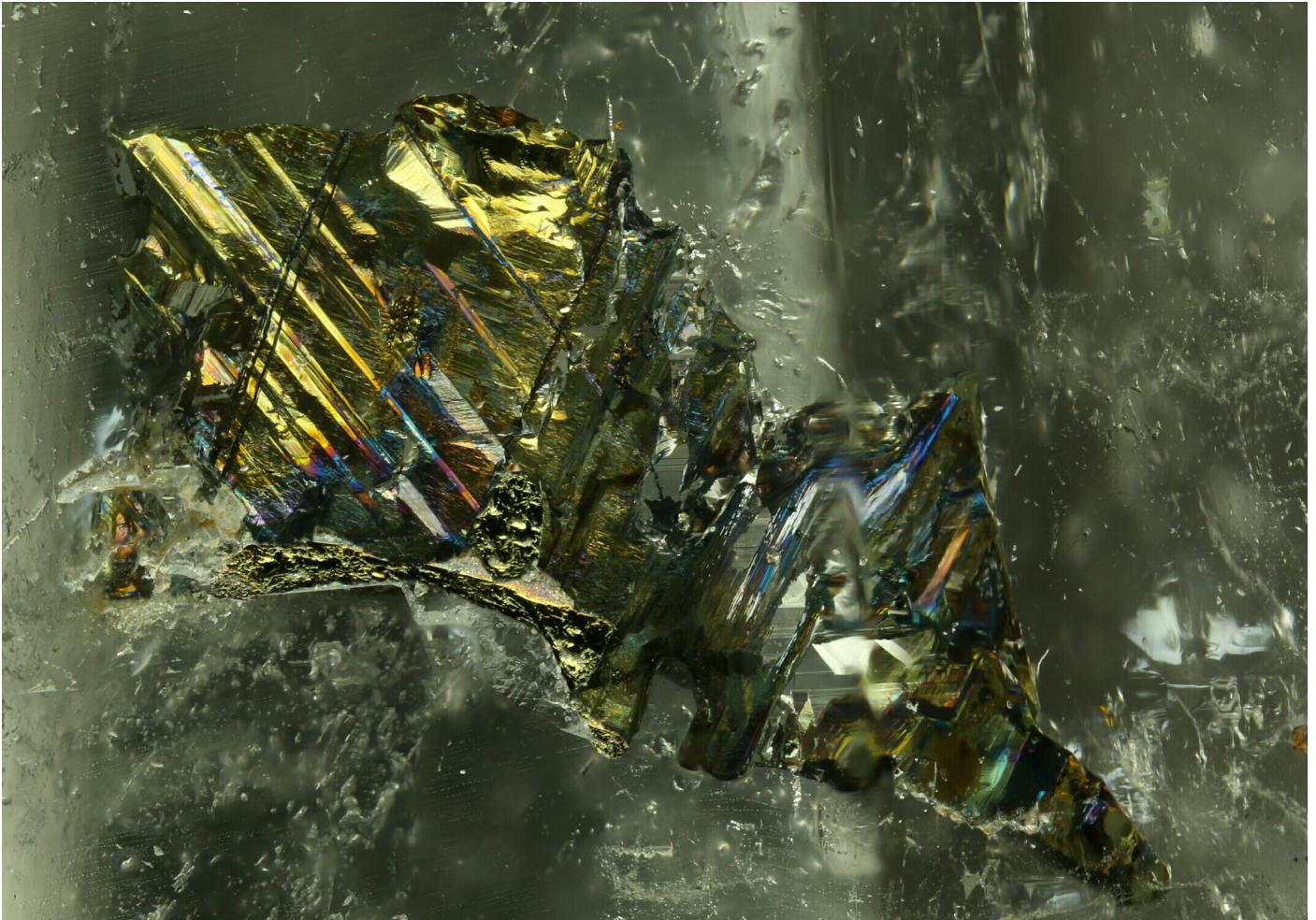
Rutile in Quartz from Brazil (Photo by Nina Zolotukhina)



Carborundum (Lab-created Moissanite) from China (Photo by Nina Zolotukhina)



Carborundum (Lab-created Moissanite) from China (Photo by Nina Zolotukhina)



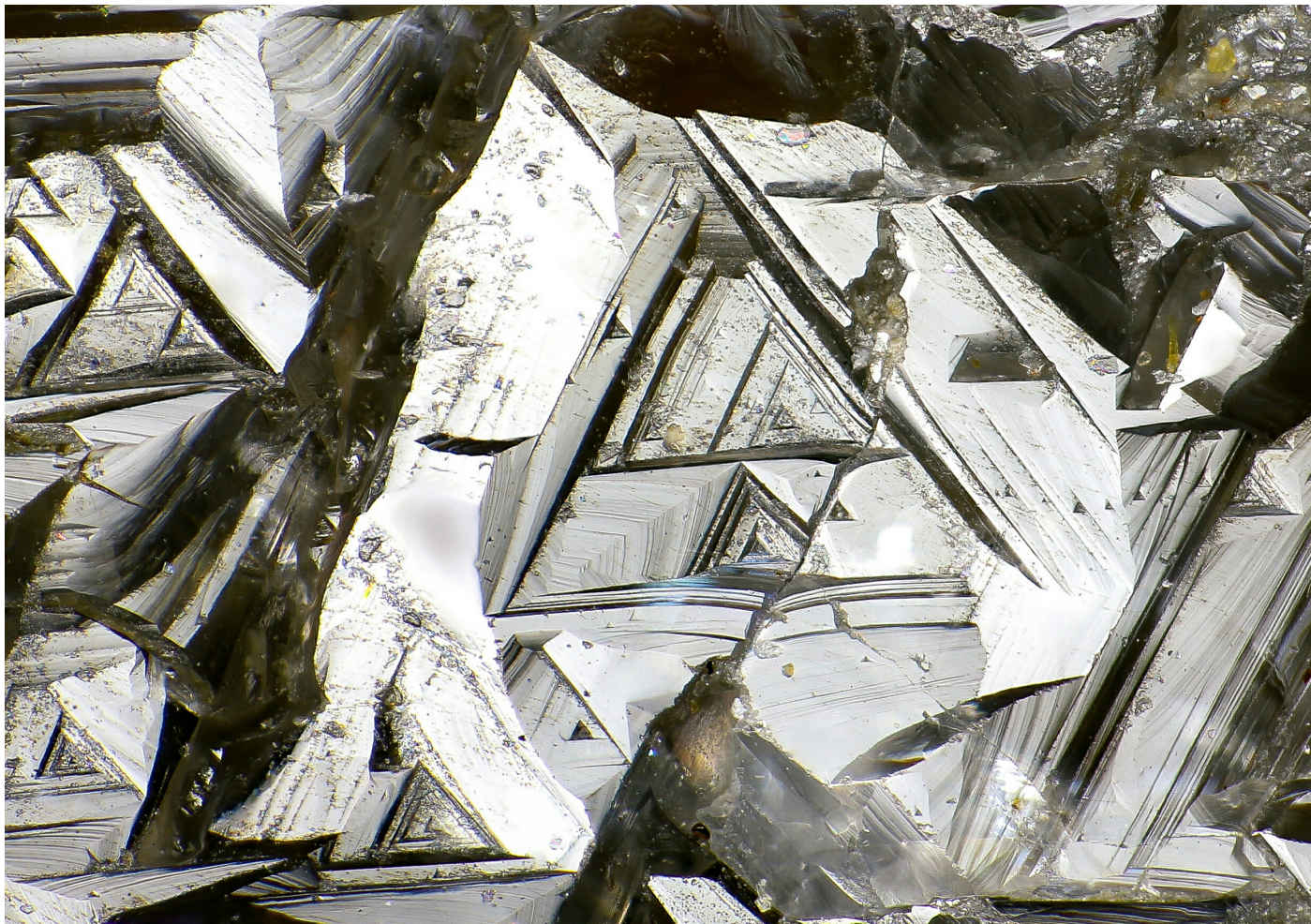
Chalcopyrite inclusion in Quartz (Photo by Nina Zolotukhina)



Dumortierite (probably Mullite) inclusions in Quartz from Brazil (Photo by Nina Zolotukhina)



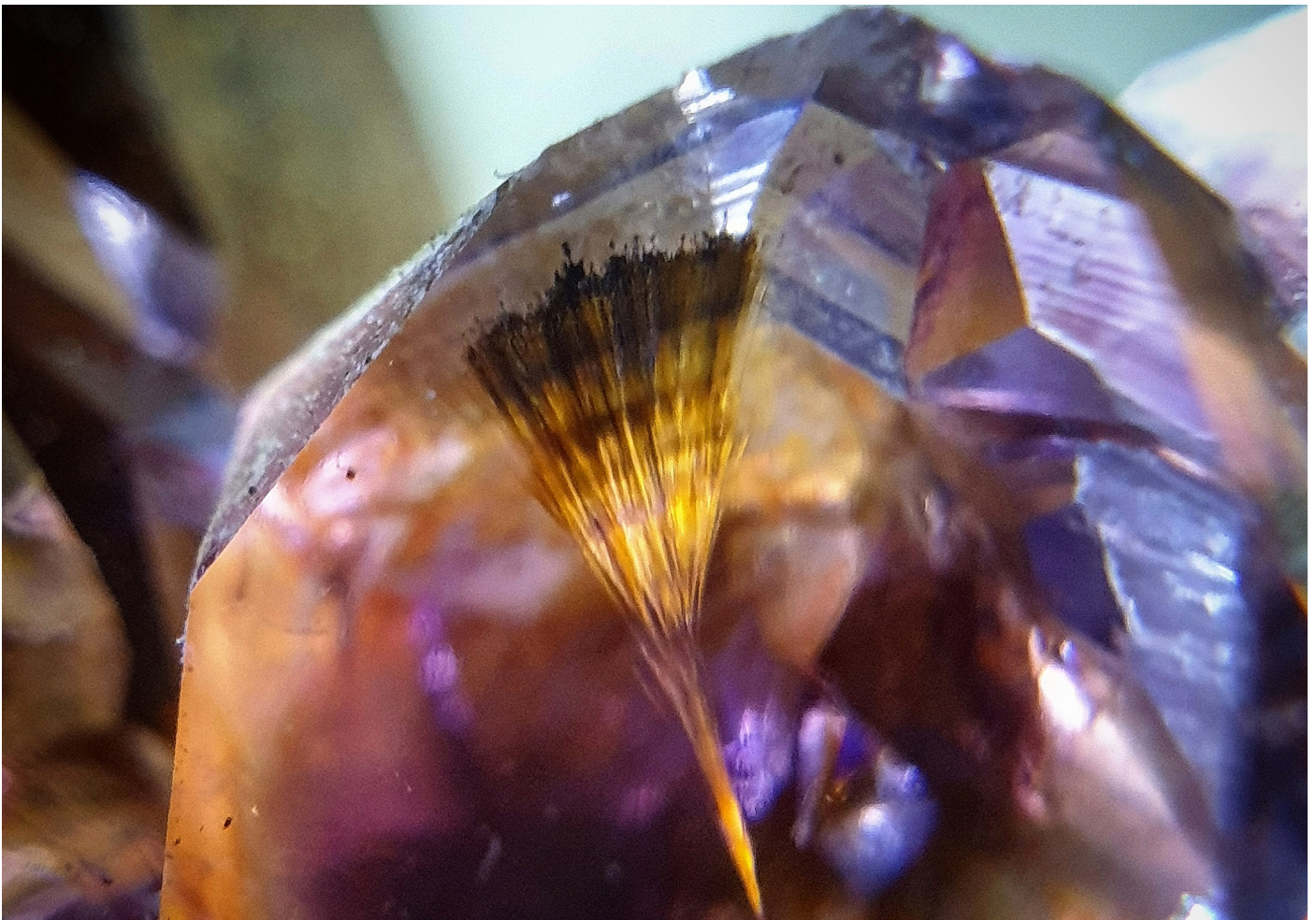
Rutile and negative crystals in Quartz from Brazil (Photo by Nina Zolotukhina)



Trigons on a Diamond (Photo by Nina Zolotukhina)



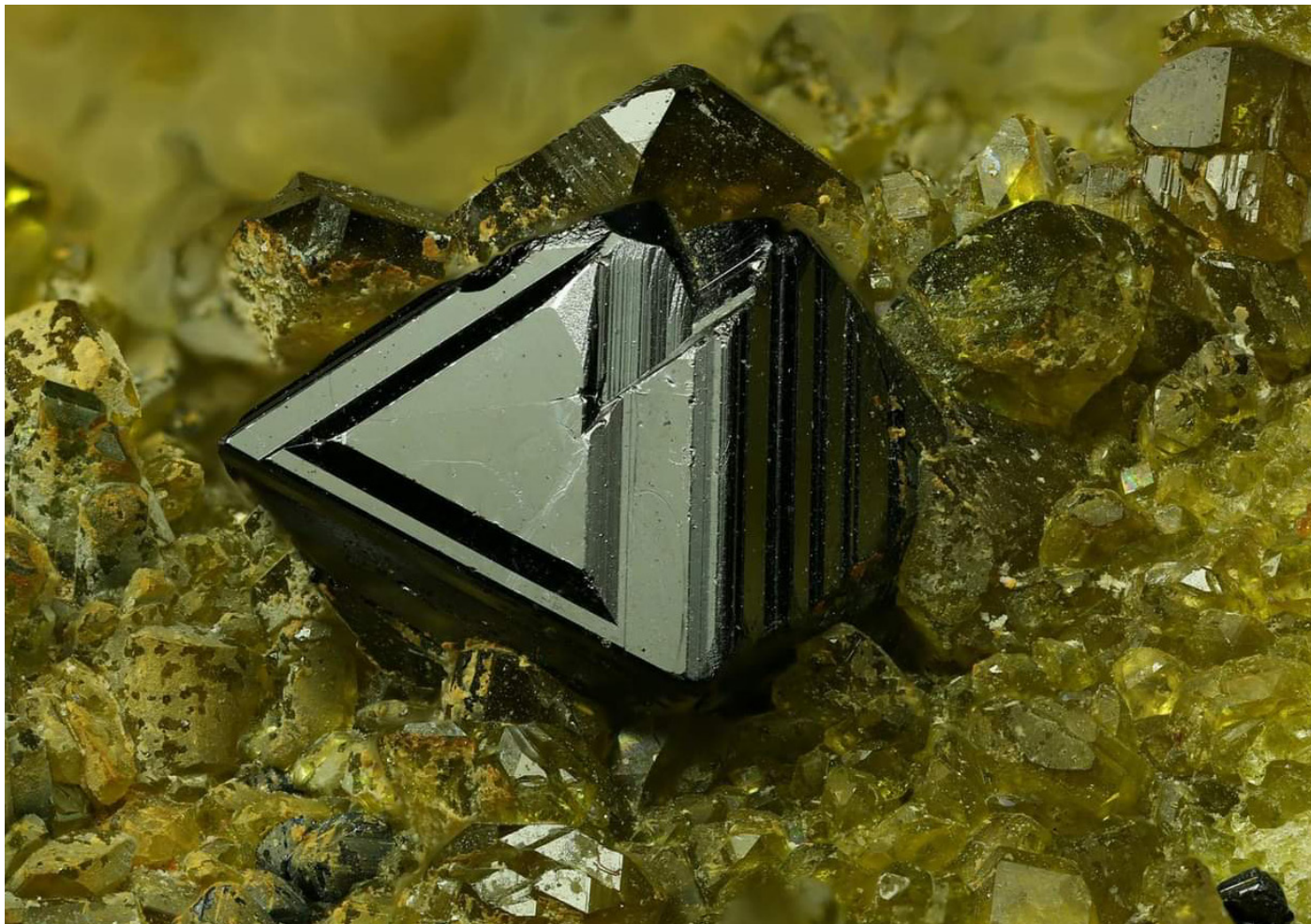
Rhodochrosite from Romania (Photo by Nina Zolotukhina)



Goethite inclusion in Amethyst Quartz from Brazil (Photo by Nina Zolotukhina)



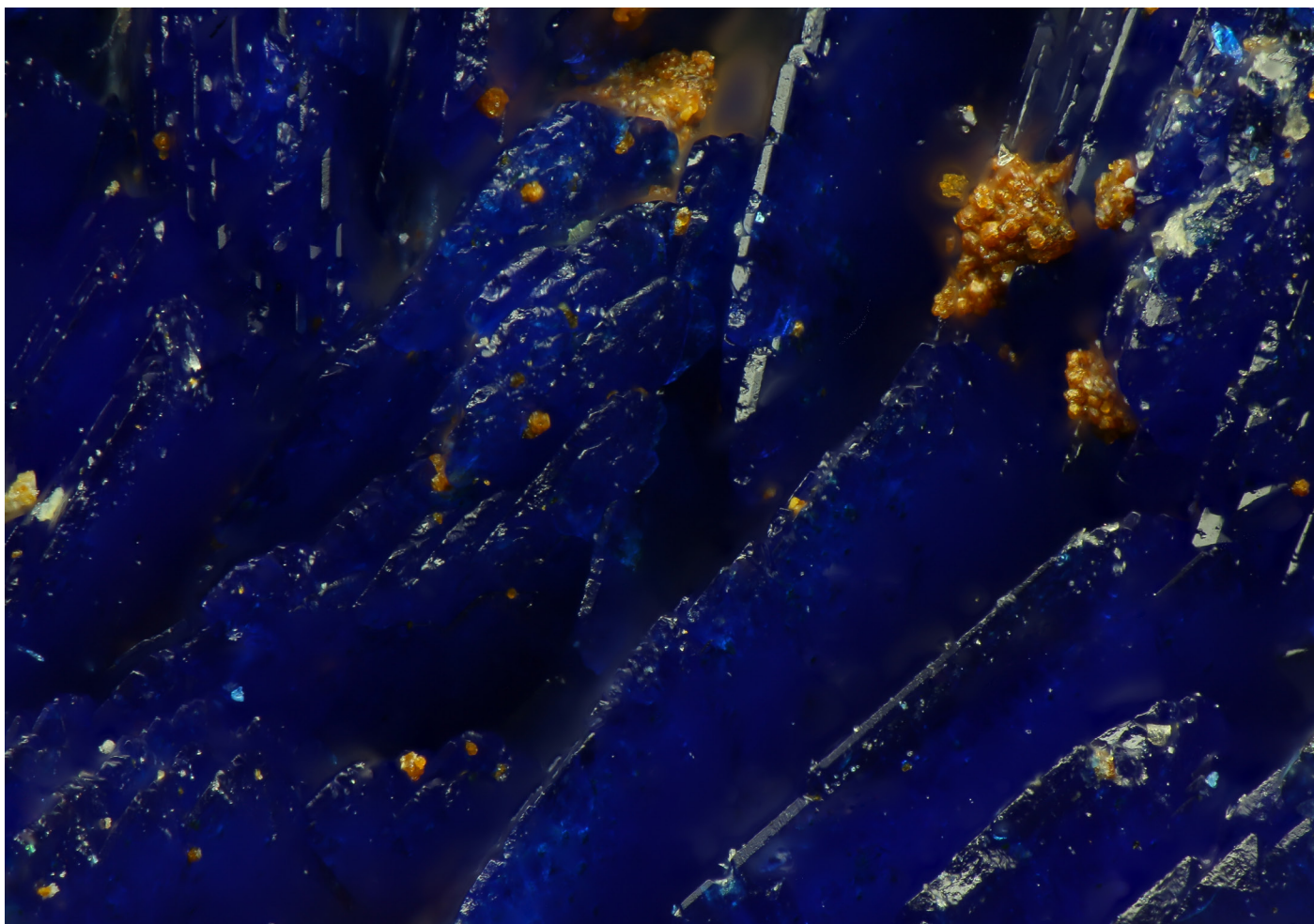
Halkantite from Poland (Photo by Nina Zolotukhina)



Magnetite on Epidote from Pakistan (Photo by Nina Zolotukhina)



Mimetite from Mexico (Photo by Nina Zolotukhina)



Azurite from Morocco (Photo by Nina Zolotukhina)



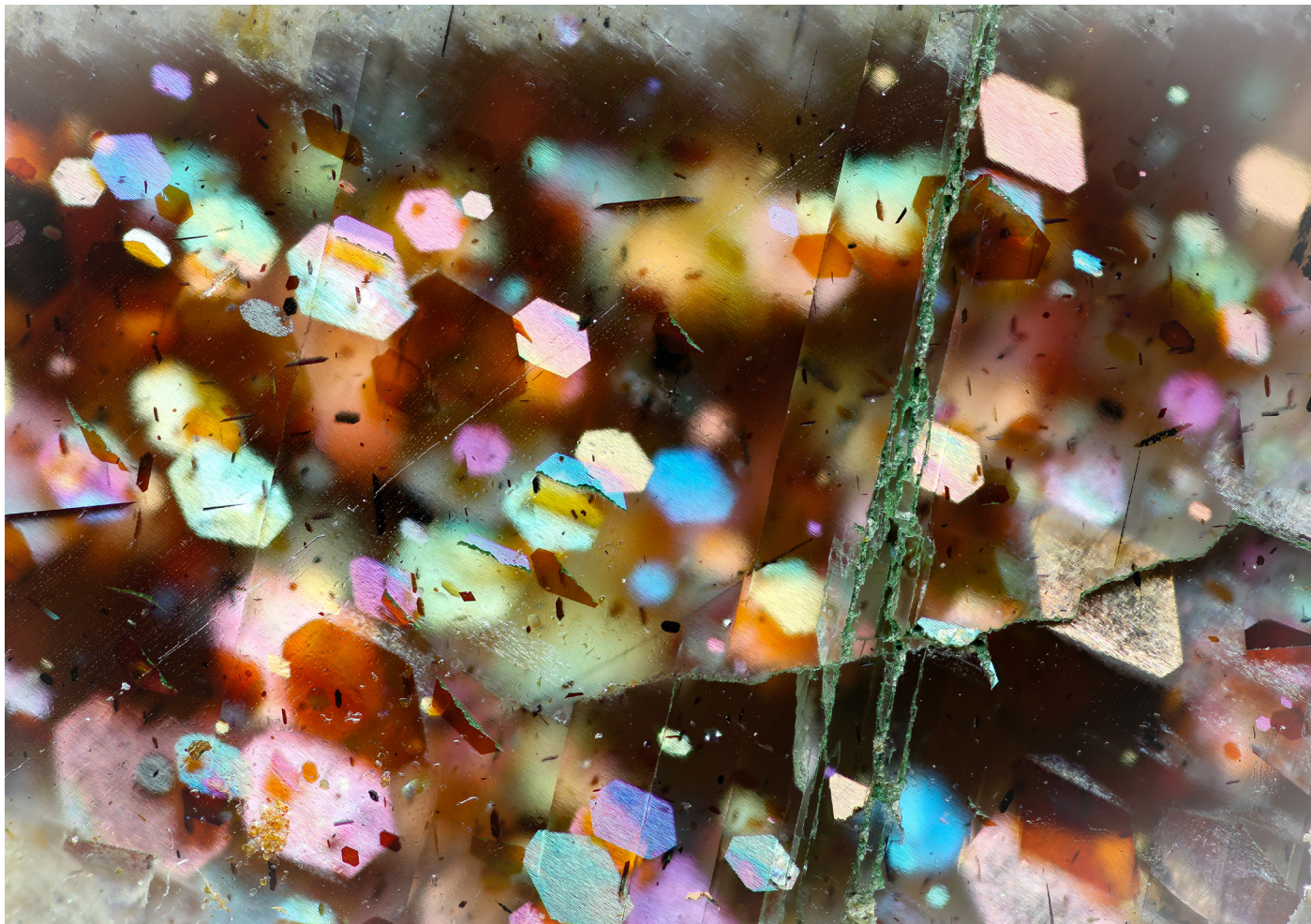
Pyrite and Iron Oxide in Quartz from Russia (Photo by Nina Zolotukhina)



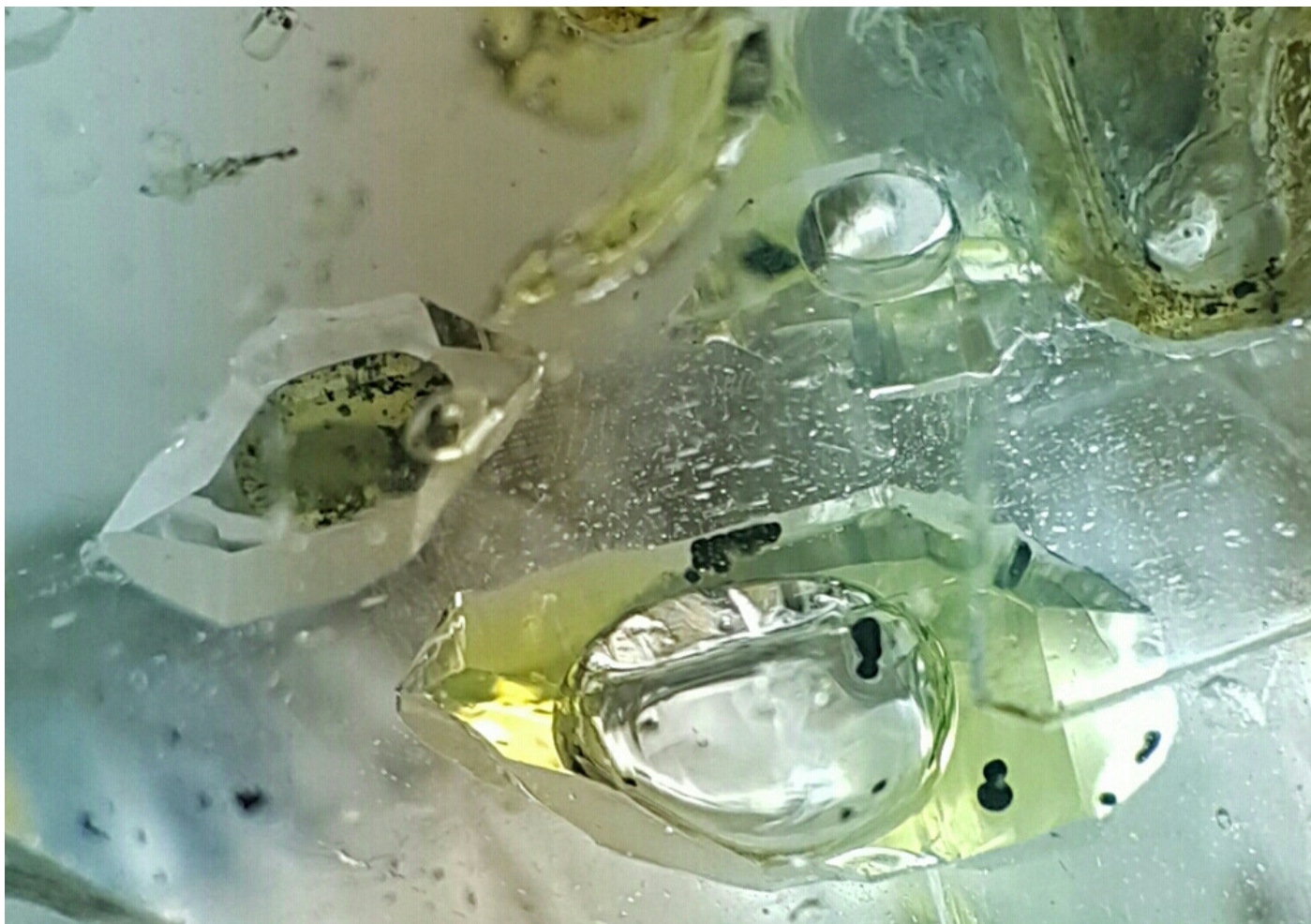
Anatase on Quartz from Pakistan (Photo by Nina Zolotukhina)



Quartz from Brazil (Photo by Nina Zolotukhina)



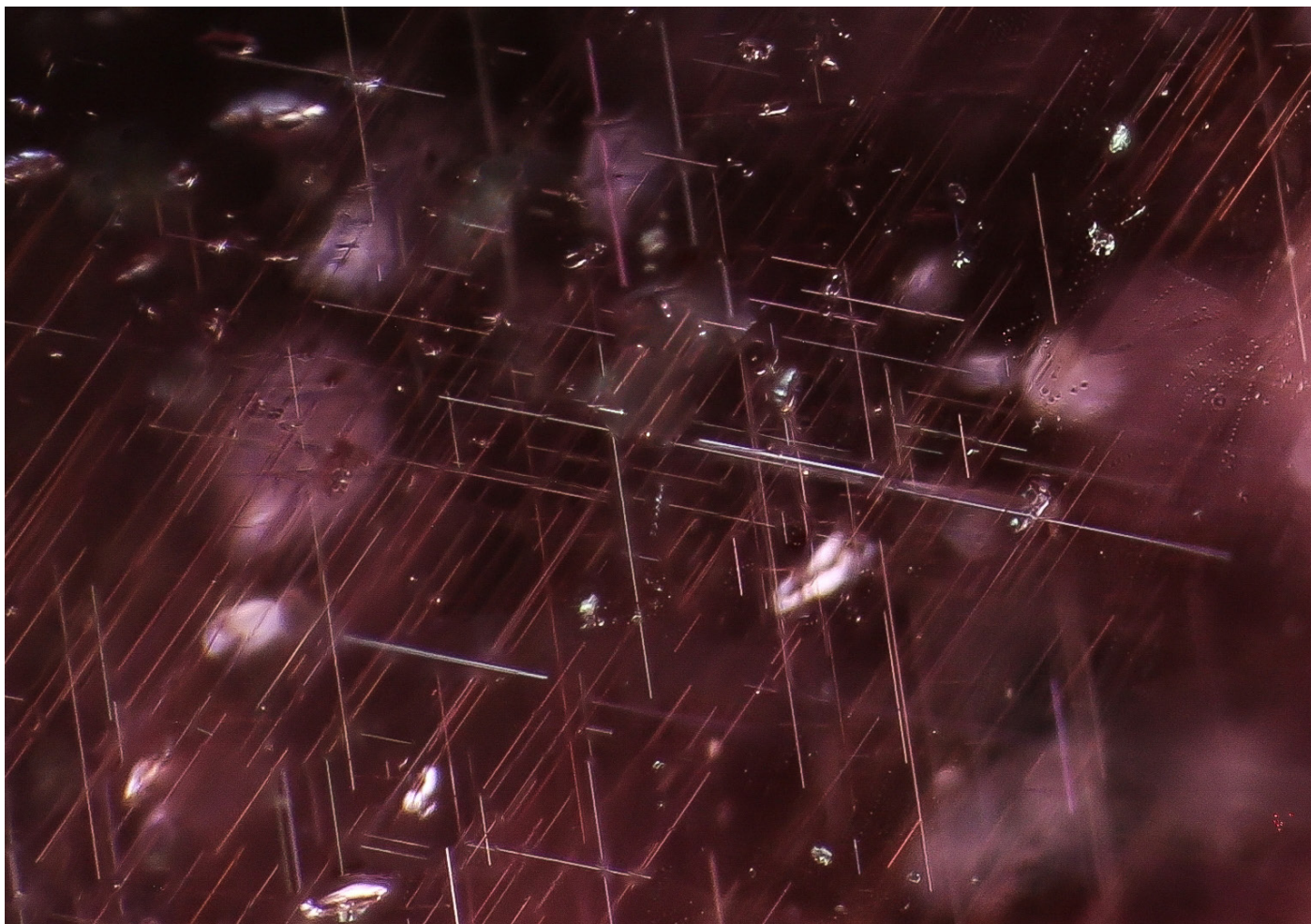
Hematite inclusions in Feldspar from Russia (Photo by Nina Zolotukhina)



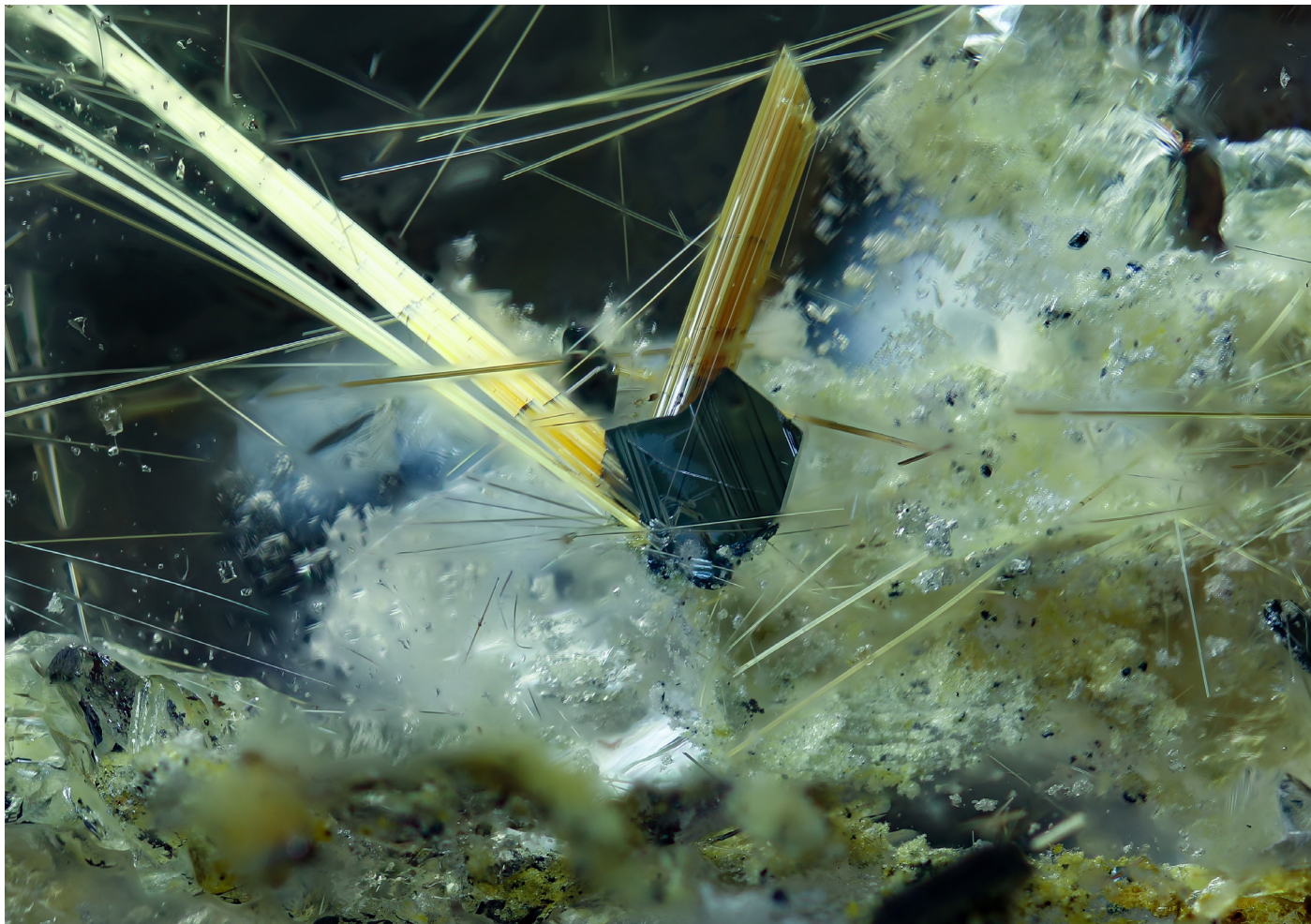
Petroleum inclusions in Quartz from Pakistan (Photo by Nina Zolotukhina)



Petroleum inclusions in Quartz from Pakistan (Photo by Nina Zolotukhina)



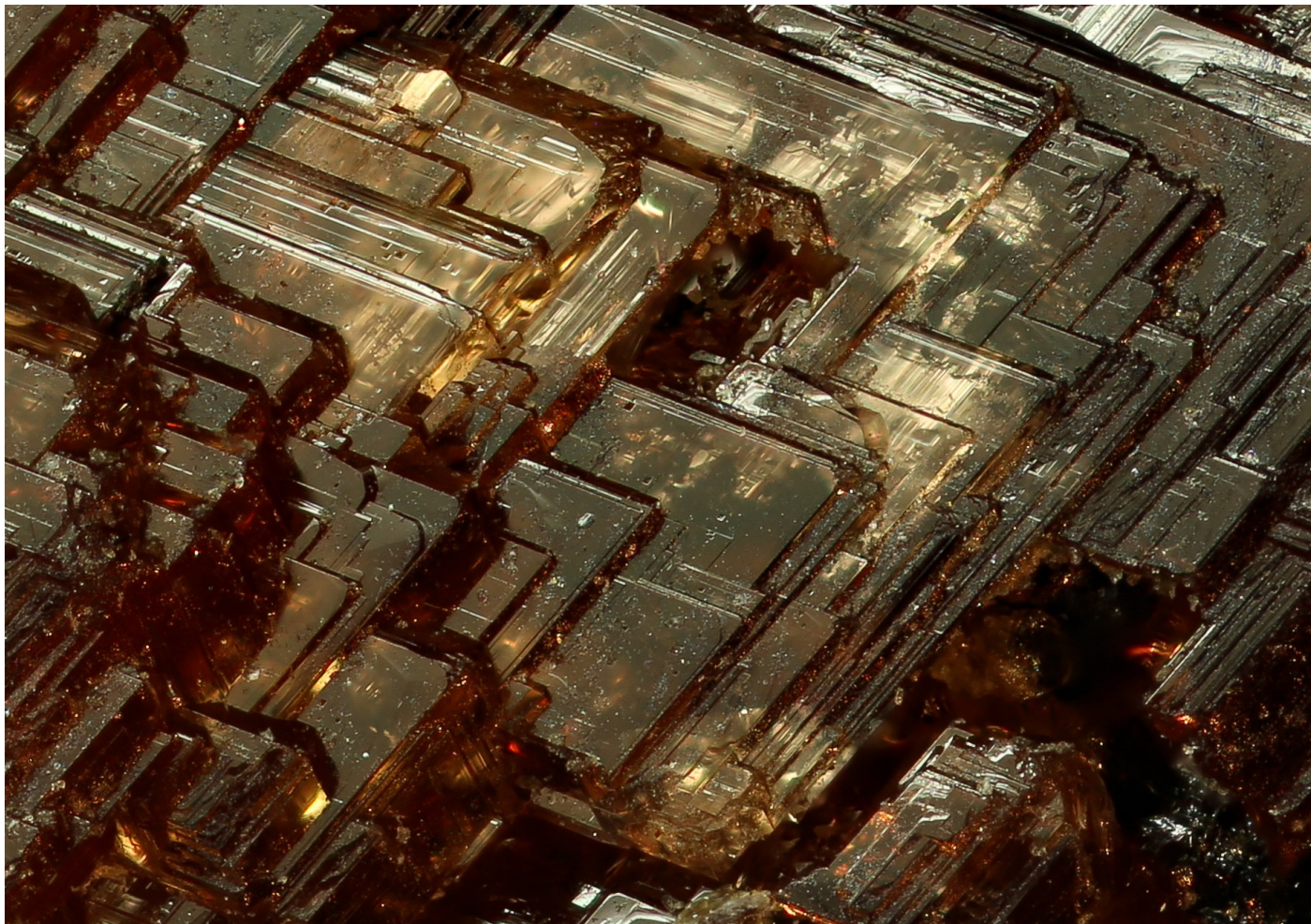
Rutile inclusions in Almandine Garnet (Photo by Nina Zolotukhina)



Rutile and Hematite inclusions in Quartz from Brazil (Photo by Nina Zolotukhina)



Silver from Mexico (Photo by Nina Zolotukhina)



Spessartine Garnet from Pakistan (Photo by Nina Zolotukhina)



Geotite and Mimetite from Mexico (Photo by Nina Zolotukhina)



Uvarovite Garnet from Russia (Photo by Nina Zolotukhina)



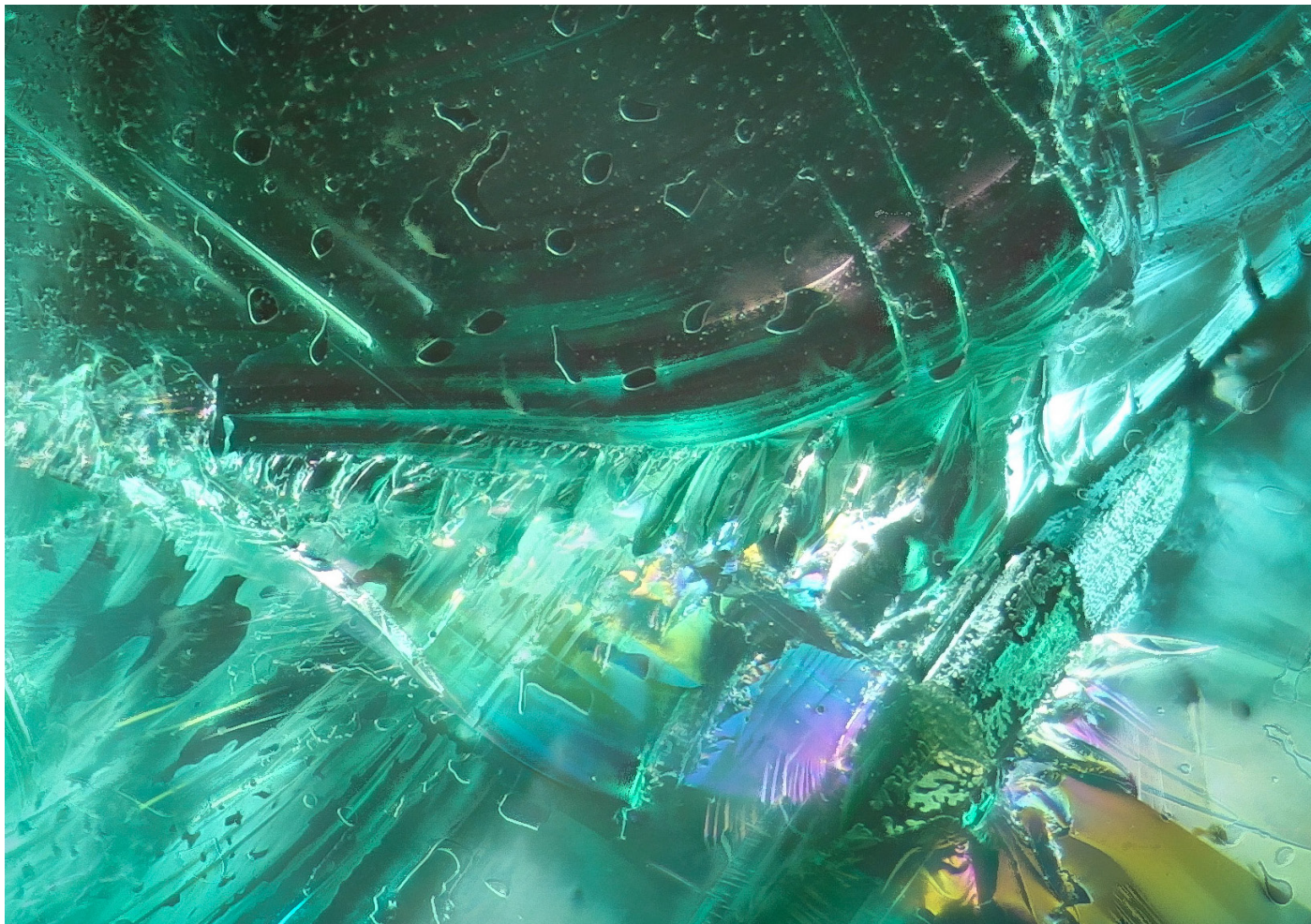
Vanadinite on Barite from Morocco (Photo by Nina Zolotukhina)



Wulfenite and Mimettite from Mexico (Photo by Nina Zolotukhina)



Dendrite inclusions in Agate from Indonesia (Photo by Nina Zolotukhina)



Emerald from Brazil (Photo by Nina Zolotukhina)



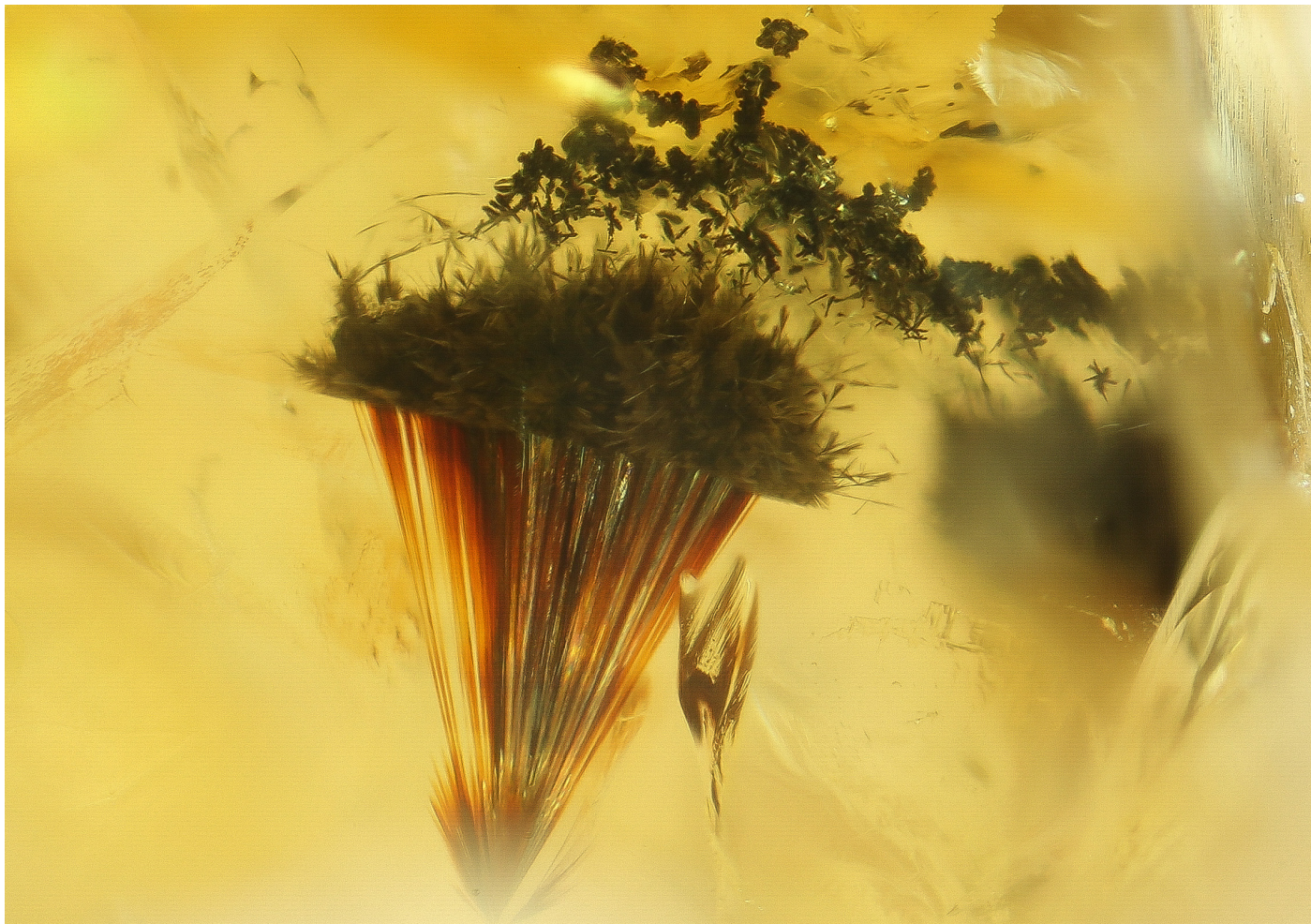
Hauine, Augite and Biotite from Italy (Photo by Nina Zolotukhina)



Apatite inclusions in Almandine Garnet (Photo by Nina Zolotukhina)



Amphibole in Quartz from Pakistan (Photo by Nina Zolotukhina)



Goethite inclusion (Dandelion) in Citrine from Brazil (Photo by Nina Zolotukhina)



'I knew we had discovered something special. Not only was it beautiful but also scientifically interesting because it was so well preserved. It could have just fallen off a shrub in my garden' (George Poinar Jr.)



A Glimpse into the Past - *Valviloculus pleristaminis*

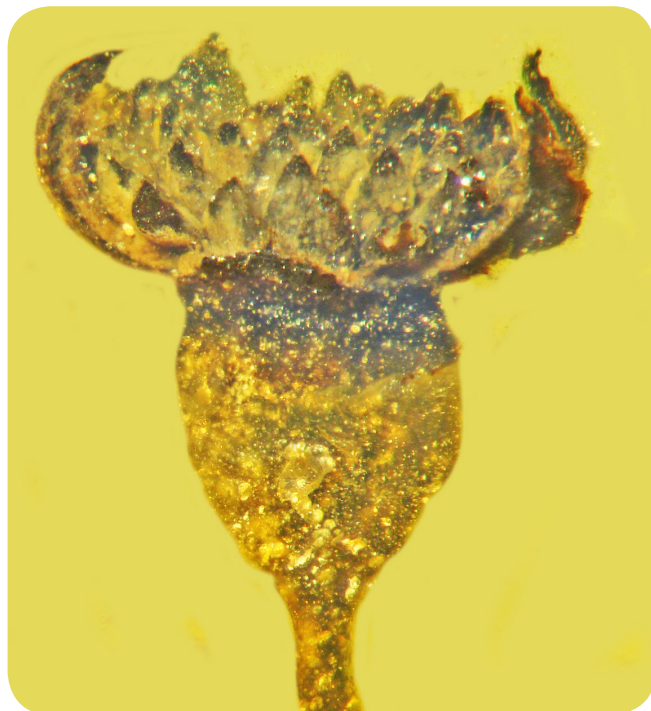


Figure 1: Ancient flower encased in Burmese amber

When I received this 100 million year old piece of amber with its fascinating flower, I knew we had discovered something special. Not only was it beautiful but also scientifically interesting because it was so well preserved. It could have just fallen off a shrub in my garden.

One of the reasons that flowers look so natural in amber is due to the preservative qualities of the original plant resin. This amazing degree of preservation is achieved, in part, to chemicals in the resins that act as natural embalming agents that enter the flower's cells. The preservative compounds began working immediately after entombment, long before the resin begins to harden into amber. These compounds also contain anti-microbial properties that kill associated decaying microorganisms, like fungi and bacteria. In addition, sugars in the resin remove water that can cause fermentation. Actually these same properties are why the ancient Egyptians preserved the bodies of their dead comrades by covering their skin with resin. The flower, with all its original features, was protected inside the amber

for millions of years. Thus the complete blossom that can be viewed from the side and top, as well as details of the numerous stamens and even microscopic pollen grains are available (Figures 1 to 4).

The views that are shown now of the flower are not those shown when the amber was received. It, like every other piece of amber, needed to be 'processed'. Most of us do not realize the amount of work that goes into preparing the amber before specimens inside can be adequately studied and photographed. The amber must be re-shaped in order to see the flower from the top, bottom and sides. I reshape specimens using a lapidary trim saw with a diamond blade to cut the amber down to a working size (Figure 5). Then the edges of the amber are removed on a belt sander using different sized sandpapers (Figure 6). A continuous flow of water should be applied during this process to keep the amber cool and wash away amber particles from the surface of the piece. Finally the surface of the specimen must be polished on a bench grinder to remove scratches from the sander (Figure 7). Obtaining the correct wax for the buffing wheels is also important in order to get a smooth, shiny finish. The most difficult challenge is with small fossils that

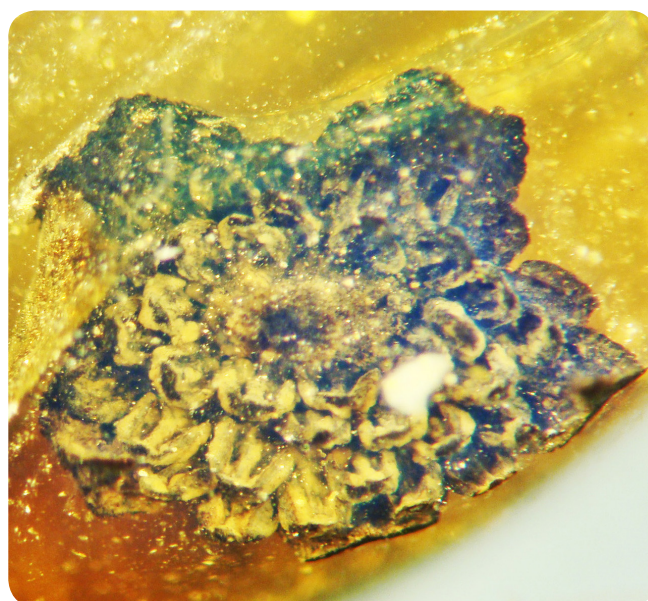


Figure 2: Top view of the ancient flower

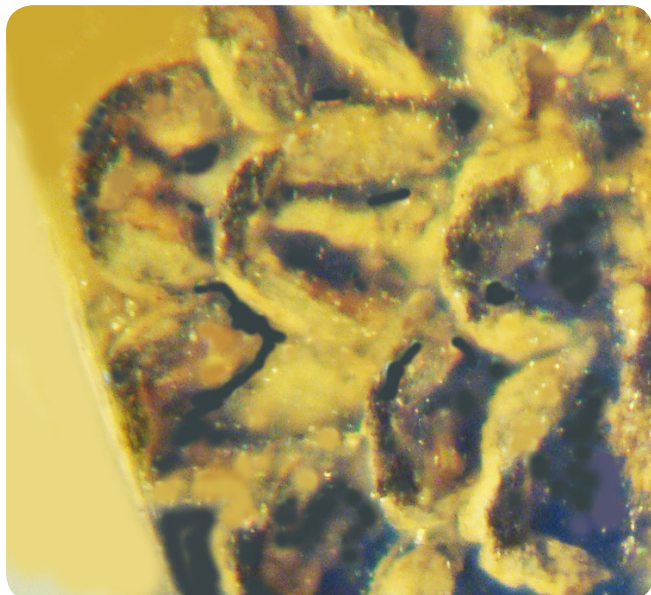


Figure 3: Detail of the anthers

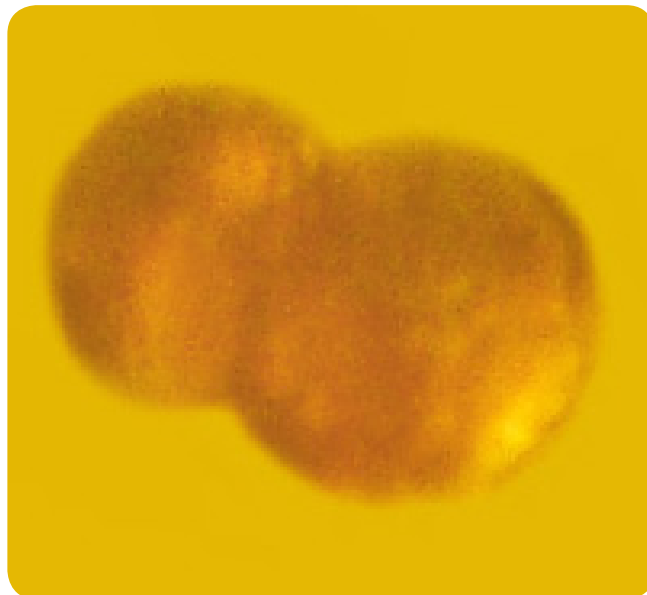


Figure 4: Pollen grains

are only a few millimetres in size. Holding the amber piece tightly against the sander and buffing wheel until the flower is close enough to the edge to be examined under the compound microscope often ends in a bloody thumb and index finger. A mask and goggles should be worn during the cutting, sanding and buffing operations. These techniques were honed years ago when I took evening classes in lapidary technology at Berkeley.

However, the processing is not over yet. After and during the final polishing, the flower has to be continuously examined. For this, I use a binocular dissecting microscope (Figure 8). Larger specimens can be photographed in their entirety under such a dissecting microscope, but smaller ones or specific areas on larger specimens need to be examined under a compound microscope. With both the dissecting and compound scopes, lighting is crucial. The best setup is to have light coming up from the base of the scope as well as overhead lights on both sides of the specimen. To obtain a range of foci for better clarity and depth of field, several photos can be taken of each specimen at different focal lengths. These can then be combined using a stacking technique such as that of Helicon Focus Pro X64. I use a Nikon SMZ-10 R stereoscopic dissecting microscope and a Nikon Optiphot compound microscope. The latter can go up to 1000X, which is quite useful for observations and photographs on small objects such as pollen grains (Figure 4).

About *Valvilocus pleristaminis*

The flower, which is both a new genus and species, has been dubbed *Valvilocus pleristaminis*, 'Valva' is the Latin term for the leaf on a folding door, 'loculus' meaning 'compartment,' plerus referring to 'many,' and staminis reflecting the flower's dozens of male sex organs. It is

a new species of angiosperm, or flowering plant, from the Cretaceous period and originates from what is now Myanmar.

While the male flower is small, measuring only 2 millimetres across, it has 50 stamens (the part that produces pollen) arranged like a spiral with anthers (the stamen's pollen-producing head) pointing toward the sky. It is thought to be part of a cluster on a plant with similar flowers, some possibly female.

In addition to its beauty, it is the fascinating journey this specimen undertook that is equally remarkable. It travelled from the ancient supercontinent of Gondwana, where it was encased in amber, to the West Burma Block continental plate, some 4,000 miles away. Gondwana then separated into Africa, South America, Australia, Antarctica, the Indian subcontinent and the Arabian Peninsula.

CONTINENTAL DRIFT OF PLATES



The location of Earth's continents at various times between 225 million years ago and the present.

Courtesy of Encyclopedia Britannica, Inc.



Figure 5: Diamond bladed saw for trimming the amber

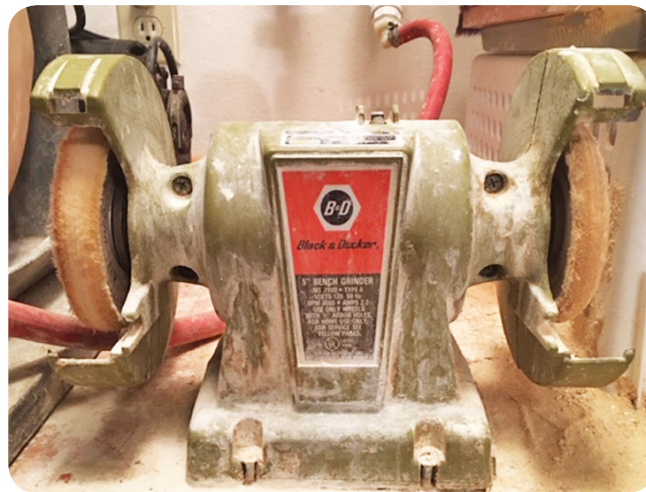


Figure 7: Bench grinder for polishing the amber

There has been debate over when the West Burma Block separated from Gondwana (ranging from 500 million years ago to 200 million years ago). Since it is believed that Angiosperms evolved and diversified some 120-100 million years ago, discovering them in Burmese amber was crucial in establishing the date when the West Burma Block separated from Gondwana, a date that was much later than originally thought.

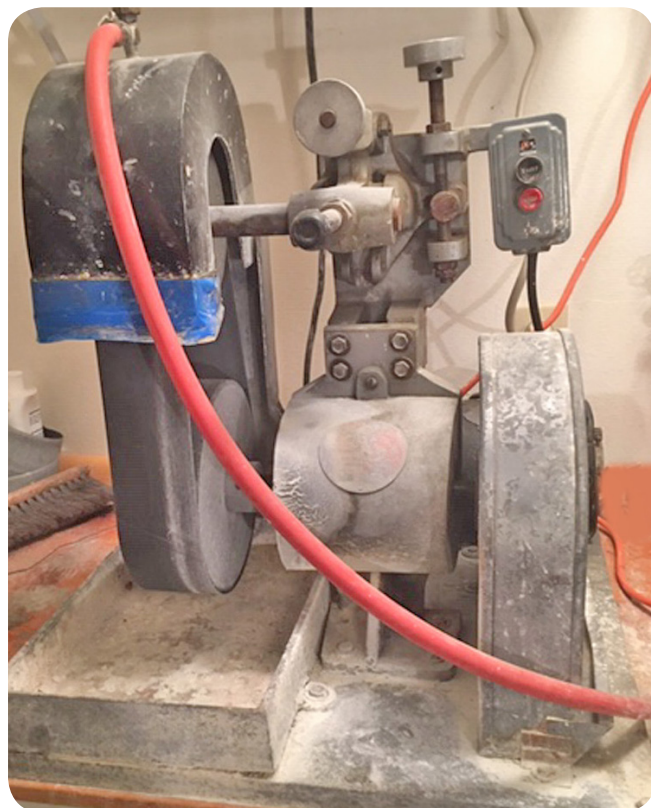


Figure 6: Belt sander for shaping the amber



Figure 8: Dissecting binocular microscope

Editors Note: George Poinar Jr. is a world-renowned expert in analyzing plants and animals found in amber - his work inspired Michael Crichton to write Jurassic Park. In 2013, Poinar uncovered a piece of amber with the oldest evidence of sexual reproduction in a flowering plant, a cluster of 18 tiny Cretaceous Period flowers. The freeze-frame moment in time includes microscopic tubes growing out of grains of pollen and penetrating the stigma, part of the flower's female reproductive system. Additional Information: Dan Avery - Dailymail.com



In this issue, Gemstone Detective Kim Rix looks at the 'Land of Hope and Glory' and what you might expect to find when travelling throughout the Eastern USA. Grab your shovel and pick because there's gold and gemstones to be found in them there hills!



Dig for Gold and Gemstones in Eastern USA

Because there are so many places in the USA with mineral deposits, you'll find no shortage of locations where you can experience the thrill of finding your own rocks, minerals, gemstones and gold. You will find gem-collecting activities for everyone – from the young amateur to the more experienced and advanced rock collector.

Note that many mines are not open to the public for safety and insurance reasons, so you will need to understand that some experiences are more authentic than others.

One of the things to keep in mind is that the USA is a big place – some of these places are in remote locations. Unless you have the appropriate wheels, try to stick to the highway or you might find yourself driving down very rough back roads. You may need to consider the type of vehicle you drive and avoid travelling a long distance for a day trip. Other considerations include where to stay, what to wear, what equipment you'll need and how to keep yourself fed and watered.

Planning your gem-hunting road trip in advance is essential to avoid being caught out by a fifty-mile detour and in urgent need of gas!

How much does it cost?

Every tourist attraction charges a different entry fee for different activities and you keep what you find. Check with each place for the price and activities they are offering.

Operating hours

Mines and tourist attractions operate according to the season. For many places the season starts on Memorial Day (last Monday in May) and a new season starts from Labour Day (first Monday of September). No two places keep the same schedule, so check their opening hours before you go.

Parking

All the listed tourist attractions offer on-site parking as well as toilet facilities.

Equipment

Typically, tourist attractions provide or rent out the necessary tools (hammer, bucket, shovel), but you are allowed to use your own tools if you have them.

Here are some additional items you might consider taking gem-hunting:

- A digging pick
- Torch for looking in cracks and gaps
- Tweezers for picking out stones
- Seating / cushion
- Kneepads for protection
- Proper footwear for walking on rough ground or standing in streams
- Gloves for hand protection
- Sunscreen and hats
- A parasol or portable shelter from the sun
- Water to avoid dehydration
- Snacks for energy
- Change of clothes at the end of the day
- First aid kit

Here are some of the activities you'll generally find on offer:

Buckets pre-filled with gemstone tailings

Every now and again, the mine will dump their tailings and fill buckets. It's luck of the draw – buy a bucket and take your chances that you might find something.

Buckets pre-filled with added gemstones

Great for kids as you are guaranteed to find some treasure in your bucket.

Dig your own gems, rocks and minerals

For a more authentic experience, bring or hire your own equipment and dig.

Tailings

Rummage through a mine's tailings pile and hunt for rocks, minerals and gemstones at your leisure

Panning

Hire or take your equipment down to the river and pan for gemstones. Buckets pre-filled with gold dirt for panning:

Every now and again, the mine will dump their tailings and fill buckets. You can take your chances that you will find some gold. Look for flakes of gold, small nuggets, or if you're lucky, you might find something bigger.

Gold Panning

Hire or take your own equipment down to the river and spend your time panning for gold.

High Banking

This is a modern machine that uses a pump to pull water up into a sluice box, so that a proper sluicing operation can take place.

Dredging

A machine that scoops out mud and rocks from the riverbed, feeding it through the trommel.

Three of the 'Top' places to explore are:

New York State

Herkimer Diamond Mines & KOA Resort

Herkimer diamonds are found in Herkimer County and are so called because to the untrained eye they look like real diamonds. They are doubly terminated quartz crystals, naturally faceted and close to five hundred million years old. They are also slightly harder (7.5 on the Mohs scale) than regular quartz. A top-quality Herkimer diamond has eighteen facets and two terminations.

Everything found in the mine has value in one shape or another, dependent on its classification. Crystals are graded from AA to D. Crystals graded AA are perfect. Crystals graded A have 5% or less surface damage, and so on down the scale. Many factors affect the value of a Herkimer diamond. It could have anthraxolite or iron in it; it might contain a hydro bubble or a rainbow fleck. The most important element is the shape of the crystal.

Arkansas

Crater of Diamonds State Park, Arkansas

For a truly authentic and unique gem-hunting experience, make your way to Crater of Diamonds in Murfreesboro, Arkansas – a 911 acre state park in Pike County. The digging site itself is a volcanic crater; now a 37.5 acre ploughed field. It's the world's only diamond-bearing site on which the general public can dig for diamonds.

More than 33,100 diamonds have been found by tourists there so there's every reason to try your luck!

Notable diamonds found at the Crater include:

- Uncle Sam, the largest diamond ever unearthed in the U.S. (40.23 carats)
- Amarillo Starlight (16.37 carats)
- Star of Arkansas (15.33 carats)
- Esperanza (8.52 carats)

North Carolina

Emerald Hollow Mine, Hiddenite

After 36 years of operation, commercial mining here stopped 5 years ago. Operating all year round, Emerald Hollow Mine has been open to the public for sluicing, creeking and digging since 1985. It is the only public emerald mine in the United States. Within a unique area of three quarters of a mile to three miles long, you can expect to find 63 types of gems and minerals, the most sought-after being emerald (beryl) and rare hiddenite. Also keep an eye out for heliodor, aquamarine and goshenite (another member of the beryl family).

Other 'Notable' sites include:

New York State

Crystal Grove Mine
Ace of Diamonds Mine and Campground

Arkansas

Wegner Quartz Crystal Mine

North Carolina

Cherokee Ruby Mine

For more information on these sites and much more, check out Kim's 'Gemstone Detective: Buying Gemstones and Jewellery in the USA' available online at www.gemstonedetective.com



Crater of Diamonds State Park, Arkansas (Photo by Kim Rix)



Digging for crystals at Wegner Quartz Crystal Park, Arkansas (Photo by Kim Rix)



Dredging (Photo by Kim Rix)



An expert and her captive audience at Crater of Diamonds State Park, Arkansas (Photo by Kim Rix)



High Banking (Photo by Kim Rix)



Hopes and Dreams - Tourists at Crater of Diamonds State Park, Arkansas (Photo by Kim Rix)

The Spice of Life

Coloured Gemstones



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



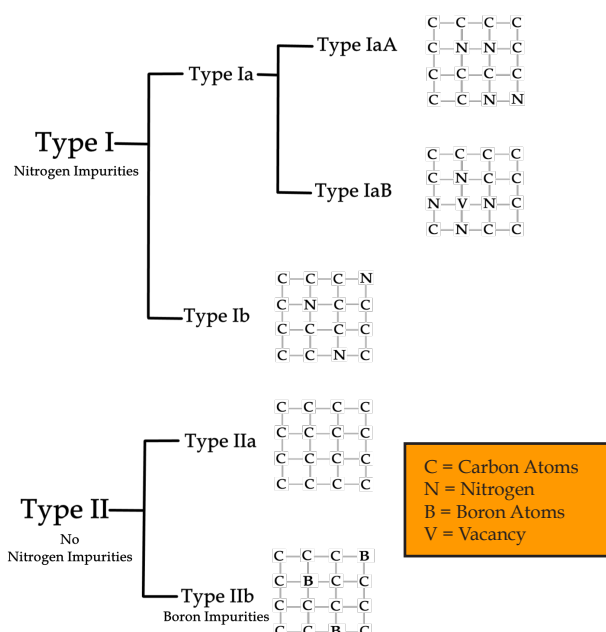
The Mysterious Chameleon Diamond

In general, diamonds are known as the 'King of Gems' and are revered for their miraculous abilities, exceptional powers and beauty, symbolizing purity, perfection, force and authority.

Diamonds are composed of crystallized carbon and are classified as either Type I or Type II. Type I diamonds contain measurable amounts of nitrogen (that can be measured via infrared absorption spectroscopy) while Type II diamonds do not.

In this article I would like to focus on a fascinating and very rare sub-type of natural green-coloured diamonds known as 'Chameleon' Diamonds.

What are Chameleon diamonds?



Chameleon diamonds are hydrogen-rich Type 1aA to 1aA/B diamonds. True to their name, they have the ability to temporarily change colour/hue with colour combinations consisting of at least two of the following hues: green, yellow, grey and brown. Don't however expect them to display intense or vivid saturation levels. Typically they are grayish yellowish green to grayish greenish yellow in colour.

Due to this unique ability to change colour, they are considered to be more unique, rare and valuable compared to similar coloured diamonds that do not exhibit this phenomenon.

History

The earliest mention of a colour change diamond dates back to 1866 by a Paris diamond merchant Georges Halphen. The first usage in the jewelry trade of the name 'chameleon diamond', dates back to 1943, when Peter Kaplan noticed the change of colour in a diamond on a hot polishing wheel. Since then these unique diamonds have been given a category of their own and have attracted the attention of gemmologists.

Where do they come from?

These highly sought-after diamonds are mainly found in southern African countries, China and the Argyle mine in Australia.

Cause of colour change

In general we know that the cause of colour in diamonds and other gemstones can be produced by impurities. In the case of 'Chameleon' diamonds, we are still not completely sure what the cause of colour change is. The main theory is that the combination of high concentrations of hydrogen and impurities are key but also phosphorescence and fluorescence can be part of the cause of colour change.

These unusual hydrogen-rich type 1aA to 1aA/B diamonds can also contain trace amounts of both nitrogen and nickel. These atoms have the unique ability to change colour when exposed to heat or after prolonged storage in the dark. To describe these reactions, we use the terms 'thermochroism' when a gemstone responds to heat and 'photochromism' when a gemstone reacts to light after being stored in darkness.

At room temperature, these diamonds typically have a colour range that extends from fancy dark green to fancy greenish-gray to fancy brownish to fancy greyish-yellow. When these



Chameleon Diamond at Room Temperature (Photo Tino Hammid)



Chameleon Diamond after heating (Photo Tino Hammid)

'Chameleons' are exposed to heat (125 to 150 degrees Celsius) for around one minute or stored for a prolonged period of time in a dark environment, the colour changes to fancy brownish-yellow to fancy intense yellow. Sometimes, in exceptional cases, these 'Chameleon' diamonds appear a fancy-orange-yellow to fancy intense orangey-yellow.

'Classic' Chameleons refer to olive green diamonds that exhibit a thermochromatic and photochromic colour change, while light yellow 'Chameleon' diamonds that only experience a thermochromatic change are called 'Reverse' Chameleons.

In most cases, the thermochromatic colour change will revert back to their more stable colour after one to three minutes, however, in some exceptional cases, the colour change can last more than 15 minutes.

How to identify a Chameleon Diamond?

The proof of colour change in diamonds can best be determined with spectroscopy (FTIR and photoluminescence) in combination with UV radiation. Chameleon diamonds can fluoresce yellow or orange under both long-wave and short-wave UV light. While the 'Classic'

and 'Reverse' groups showed different spectroscopic and UV fluorescence characteristics, all stones exhibited strong long-lasting phosphorescence after shortwave UV excitation with a 'yellow' glow of more than one hour reported.

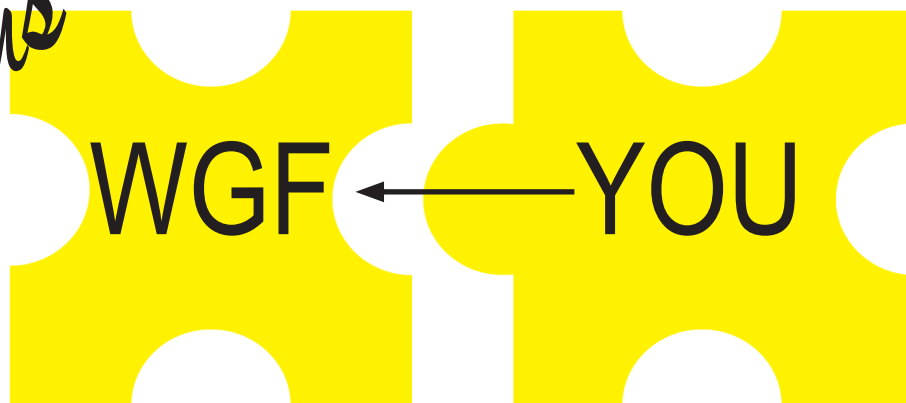
Conclusion

The fact that we still do not know precisely why this colour change occurs makes these diamonds even more alluring and mysterious! I am also sure there must be more 'Chameleon' Diamonds out there but the question is 'Do their owners even know!' I look forward to new research opportunities and sharing this knowledge!

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Join us



Interested in establishing your own gem academy or offering our programs or courses through an existing school, college, university or gemmological organization? Why not call us?

Please contact us at:

information@worldgemfoundation.com



Meet the Team



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

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

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

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

In 2018, Geoff released a 5th Anniversary Printed Edition (Two Volumes) and on December 14th, 2019, released his first book in Spanish 'Gemología Para Todos' (the first 14 chapters of the Handbook of Gemmology).

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

Leone Langeslag (Dutch Gem Academy) 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 led to the formation of the Dutch Gem Academy.

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

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

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

Conny Forsberg (Scandinavian Gem Academy) 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 photomicrographs featured in the 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) is a gemmological consultant specializing primarily in the identification and valuation of diamonds, both cut and rough, as well as coloured gemstones and jewellery.

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

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

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

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

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

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

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

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

Marie-Hélène Corbin (Gem Academy of Canada & Gem Academy of Belgium) is an FGA gemmologist and accredited Senior Gemmologist through the AGA.

Following a busy career in real estate, she wanted to change her professional path and became interested in gemmology. This discovery of gemstones turned into a passion. Marie-Hélène studied at the EGM and successfully passed her Gemmology Diploma.

Guided by the desire to pass on her love for gems, she became the new Director of EGM in 2016, with a strong desire to modernize the school. As a teacher, she instills in her students the desire to learn more about the world of gemstones.

This passion for gems does not stop there, and Marie-Hélène created Quebec's first independent gem identification laboratory, Lelièvre Laboratoire de Gemmologie (LLG) in 2018. In order to offer the most complete service to her clients, she created the Gems and Jewelry Appraisal Center in 2019, also in Montreal.

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

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

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

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

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

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

In 2002 he relocated to England where, ten years later, he found the opportunity to fulfil his dream of studying gemmology at the Birmingham City University. In 2012, he started his High National Diploma in Gemmology combined

with Gem-A's Diamond and Gemmology program which led to a degree program, introduced for the first time in 2015, at the BCU.

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

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

Jack Ghazalian (American Gem Academy) has thirty-eight years of experience in the jewelry industry. He is a graduate gemologist through the Gemological Institute of America (1992), was an instructor for GIA (1993) and was officially Certified-by-the-State of California Education Code 94311(a) to teach Gemology & Jewelry Manufacturing-Arts (1993). In October 2015, he was honored by the International Distinguished Scholars – Academic Honor Society as an 'International Distinguished Scholar' and in 2017 was granted membership in Kappa Delta Pi. He is currently the owner of Isometric Gemological Appraisal Services in Southern California: IsometricGems.com, speaks five languages and is passionate about education.

Barickeh Charles Kholifa Koroma (West African Gem Academy) is a freelance gemmologist, diamond grader/valuer, a member of the Gemmological Association of Great Britain and a member of the Scottish Gemmological Association. He was born in Liberia to Sierra Leonean parents and raised in the mineral rich country of Sierra Leone where he survived a devastating brutal civil war which lasted for almost 12 years.

He relocated to the United Kingdom in 2004 and received help on how to cope with Post Traumatic Stress Disorder (PTSD), which now proves pivotal in his approach to life.

He attended the coveted School of Jewellery, Birmingham City University (BCU) where he studied a diploma in diamonds (Gem-A) and a BSc (Hons) in Gemmology and Jewellery Studies. He graduated with a first-class degree in 2018 and was awarded the prestigious Scottish Gemmological Association Prize for Gemmology. He then moved back to Sierra Leone to pursue his dreams. His greatest achievement so far is working as a student mentor during his time at the university, he was able to give advice and guidance to some students that were struggling to cope with the demands of higher education and being away from home.

Like Kyalo, he comes to the World Gem Foundation and specifically the West African Gem Academy with a strong desire and ambition to share his knowledge of gemstones with his fellow West Africans, particularly those involved in the production of gemstones, gemstone lovers and aspiring gemmologists, to provide support and encouragement that was so lacking in the industry when he was growing up in Sierra Leone.

Dr. Laurent Massi (French-Swiss Gem Academy)

completed his PhD studies on 'Atomic-scale Defects in Brown and Hydrogen-rich Diamonds' at the Department of Physics at Nantes University in France under the direction of Professor Emmanuel Fritsch. During his studies he also taught gemology in Paris at the French National Gemological Institute. Dr. Massi subsequently taught gemology and gave presentations at conferences in numerous countries all around the world. During his career he has also had the opportunity to publish a variety of scientific and educational articles on color-change corundum, hydrogen- and CO₂-related optical centers in diamond, chameleon diamonds, clinohumite, color-change bastnäsite and on a new gem mineral: hibonite, one of the rarest gems on Earth.

Dr. Massi was the Director of the Asian Institute of Gemological Sciences (AIGS) Gem Laboratory and Gem School based in Bangkok - Thailand. He subsequently completed his Graduate Gemologist (GG) studies at the Gemological Institute of America (GIA) headquarters in Carlsbad, USA and then became the Director of the new GIA Thailand Campus located in Bangkok - Thailand.

With more than 20 years of experience in the Gems & Jewelry industry, Dr. Massi is now the head of both the new international gem academy AGAT (for 'Academy of Applied & Technical Gemology') as well as the co-founder of the French-Swiss Gem Academy (from the World Gem Foundation), both housed in the Majestic building - a former palace from the Belle Epoque - located on the French Riviera, in Nice - France.

Ludovic Durand Oro (French-Swiss Gem Academy)

graduated from the Federation for European Education in Gemmology (FEEG) in 2012, has taught at the French Gemological Institute in Paris (France), was the Director of Education of a gem school based in Monaco and in 2019 co-founded the Academy of Applied & Technical Gemology (AGAT gem school) as well as the French-Swiss Gem Academy (FSGA), both based on the French Riviera in Nice, in the south of France.

A true gem enthusiast, he loves to organize gem field trips for his students to gem producing areas around the world while also acquiring top quality gemstones for his private clients.

Cristina Rzepka de Lombas (Central American & Caribbean Gem Academies) 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.

Nina Zolotukhina (Eastern Europe & Russia) studied gemmology at Moscow State University, is an independent gemmologist, now based in Bulgaria, founder of Gemlab Europe Project, researcher, gem expert and author of reviews and articles about gemstones, research methods and gemmological equipment. She is an avid mineral and gemstone collector and photographer of minerals and inclusions (photomicrography).

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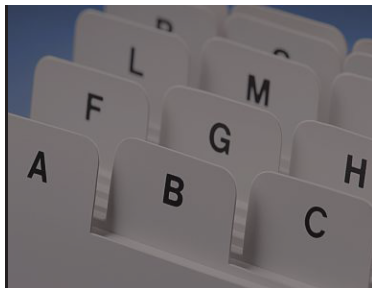
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Australian Opal Centre

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

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