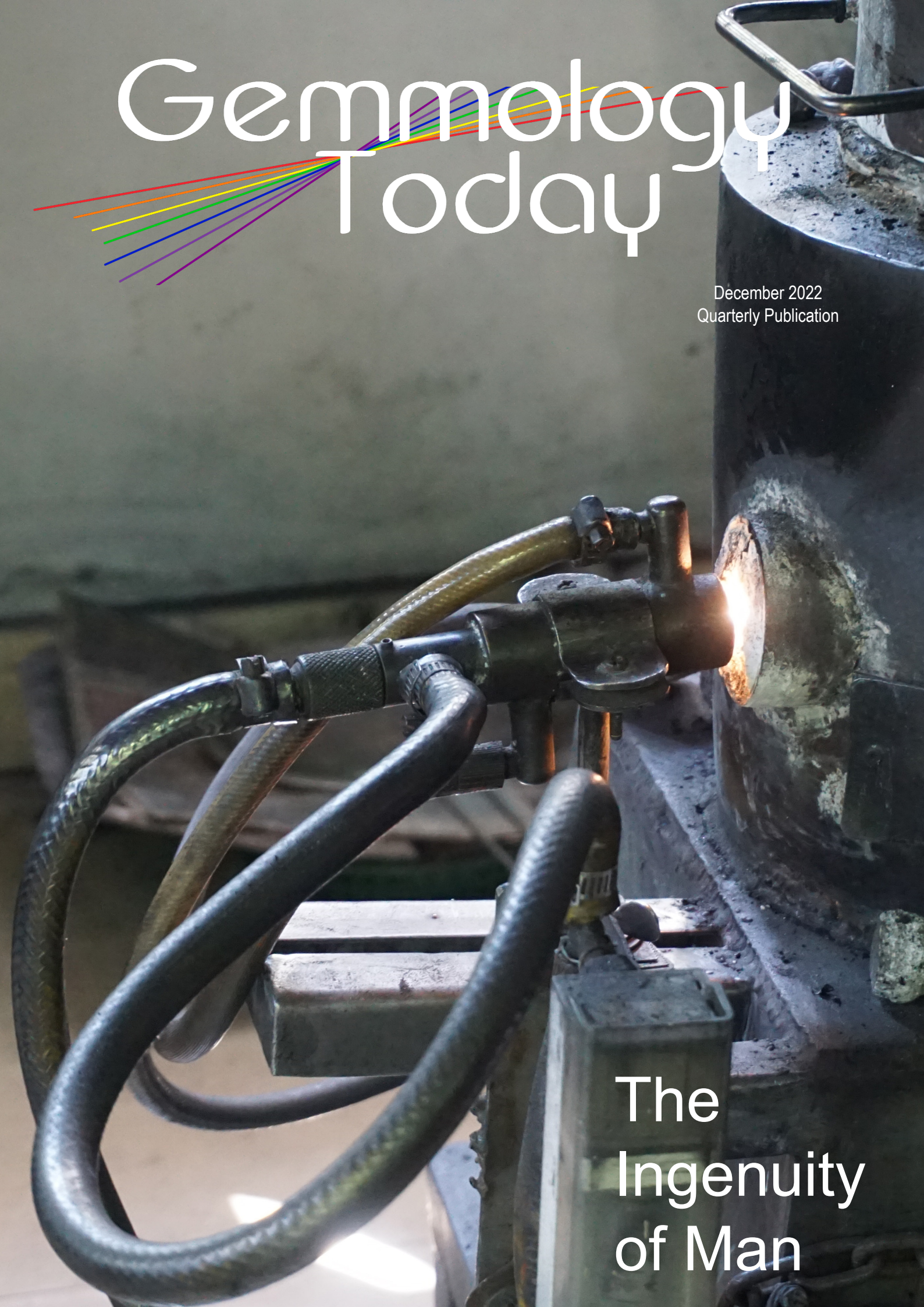
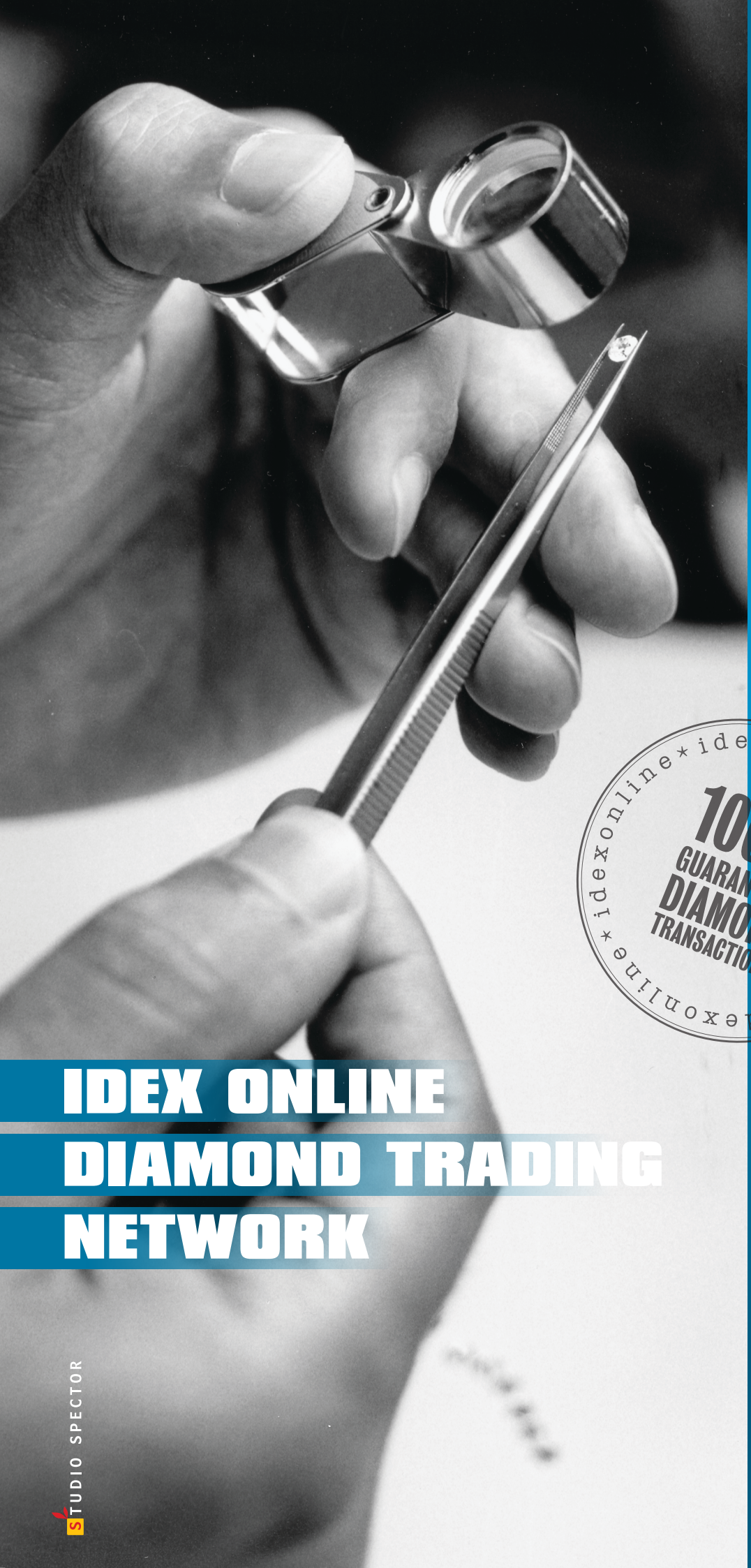
Gemmology Today

December 2022
Quarterly Publication



The Ingenuity of Man



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STUDIO SPECTOR

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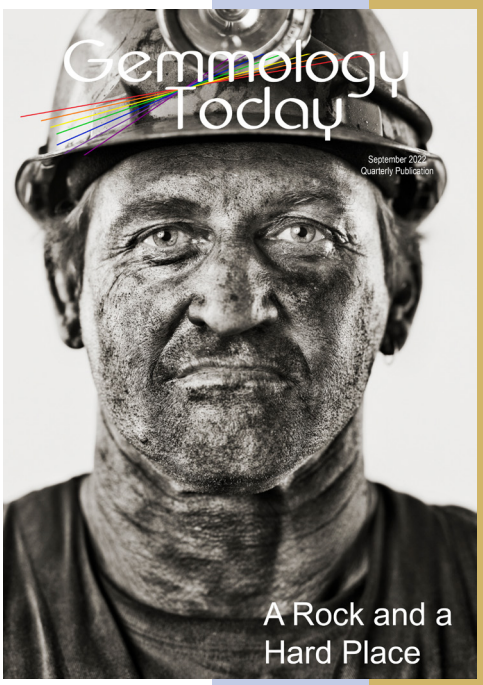
Cover: Heat treating furnace / Photo by Geoff Dominy



Click here to read the September 2022 Issue

Geoff Dominy - Founder / Editor

Greeting from Ethiopia! An awful lot has happened since the last issue. I am now living in the 'Horn of Africa' co-ordinating Project Africa, an initiative that will change the current dynamic here in Africa and make gemmological education affordable and accessible to students throughout Africa.

I am no stranger to moving. I grew up in England and then moved to Canada, Peru, Spain and now Ethiopia. Moving is never easy but co-ordinating the move to Ethiopia was challenging to say the least. The silence at the end of the phone when I told the various shipping companies where I was going. Three weeks later, I am still waiting for my boxes to arrive even though they are coming by Air Freight. Initially they were supposed to go from Palma to Barcelona by truck and ferry and then from Barcelona to Cairo and then onto Addis Abeba with Egyptair. For some unknown reason, Egyptair announced that due to a backlog, they would not be transporting my goods. I am not sure why they would not schedule more flights. Happiness is having too much business....right? I was then informed that they would go to Paris and then onto Addis. That did not happen either. Finally the contract was given to Saudi Airlines and they would travel from Barcelona to Jeddah and then onto Addis. I know they left Jeddah but where they are at this particular moment is anyone's guess!

Editor at Work

WHAT'S IN THIS ISSUE?

The response to the last issue was overwhelming. It was one of the most difficult issues to put together but we were all delighted with the end product and so were our readers. As promised, we continue our journey through the supply chain and in this issue, we will focus on lab-created gemstones, treatments and enhancements.

This is an area that truly fascinates me. The 'Ingenuity of Man' in not only replicating nature but finding ways to improve the appearance and often the value of gemstones. I know it is a contentious area of the gem industry but I believe everything has its place provided there is full disclosure. If you have ever studied a Chatham ruby or emerald or examined a lab-created diamond, you will understand. Yes they are man-made but why are the efforts of man to recreate nature any different from nature itself? While diamonds have the simplest chemical composition of all gemstones, they proved the hardest to synthesize. It took years of research and development to finally produce lab-created diamonds and those who achieved this feat should be heralded as true pioneers.

I would have loved to have met Carroll Chatham. Through the Handbook of Gemmology, I got to know his son Tom and he once told me that he thought we would have had some interesting discussions.

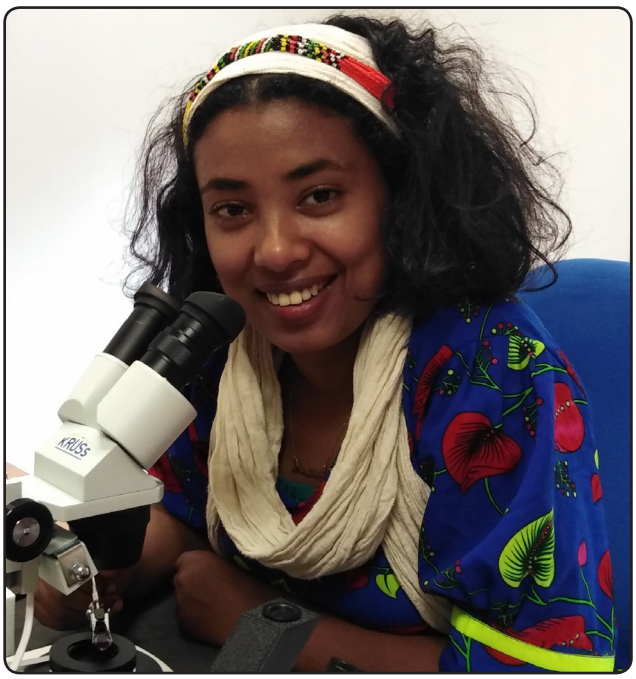
I remember years ago meeting a client who wanted a two-carat emerald. It was obvious by her description that what she wanted and what she could afford where miles apart so I started to show her alternatves. We talked about tsavorites, chrome tourmalines and Chatham emeralds. Finally she chose a lovely chrome tourmaline that gave her the look she wanted at a price she could afford. A week later, a student of mine (who worked in a jewellery store) called me. The lady had taken the ring in and she had noticed the trade mark. She asked me when I had started selling Chatham emeralds. I asked her why? She said the lady had told her that the stone was a Chatham emerald. I was confused. Yes we had talked about them but the stone in her ring was a chrome tourmaline. I called her up and explained what had transpired. She laughed. Of course she knew it was a chrome tourmaline but she said no-one would know what it was so she was telling everyone it was a Chatham emerald. I think Carroll would have been pleased!

In 2014, I left the jewellery appraisal sector to focus on education. I am glad I did because with the influx of lab-created diamonds, appraisers are facing challenging times. The prevalance of lab-created diamonds requires a significant investment in diamond screening devices in order to determine the origin of diamonds. With micro-pave set jewellery so popular, the thought of testing one hundred and fifty .5mm melee stones set in a piece of jewellery is daunting. Many appraisers still do not understand why they must make this investment and that is unsettling. It takes years to build up a reputation and seconds to lose it. Trust me, lab-created diamonds look no different to natural diamonds. They are a thing of beauty and will fool even the most seasoned professionals. Unlike lab-created rubies, sapphires and emeralds that invariably contain tell-tale inclusions, lab-created diamonds are far more difficult to detect. They may have some inclusions that indicate they are lab-created but when dealing with higher quality stones, it is impossible.

Treatments and enhancements are another area that can give appraisers and anyone involved in the buying and selling of gemstones sleepless nights. While some are easily identifiable (irradiated and annealed blue topaz), others are not and if we look at the effects on their value, costly mistakes can be made.

I have often wondered how long a treatment or enhancement is in the market place before some-one discovers it. Days, months, years? Naturally treaters will never disclose what they are doing so it is up to us to identify them and then find ways that will aid in their identification. GIA have been leaders in this field for years and without their research, we would all be left floundering. Again I am fascinated by these treatments and enhancements. It is pure science and perhaps a telling reminder that gemstones are one of the most complex consumer products in the market place. It is no mean task to explain what happens chemically when you heat treat a blue sapphire. I know that most engaged in the jewellery trade are not scientifically minded but surely, it is essential that you know more than the consumer. The Internet is a wonderful tool but with so much misinformation it is often more a curse than a blessing. If you do not have the knowledge, how will you explain what is happening to a customer who has perhaps stumbled onto a website that is full of untruths?

We must never minimise the importance of education. It is not a cost of doing business but an investment. Knowledge gives confidence and confidence gives credibility. It is what separates the wheat from the chaff.



Haimanot Sisay - Associate Editor

So back to this issue. Interviews with Tom Chatham and Dr. John Emmett who is an authority on the treatment of corundum, Antoinette Matlins takes the 'Point" position on why treated gemstones are acceptable while Haimanot takes the opposing position and argues why natural is better. We look at all the common treatments and enhancements, touch on the contentious issue of 'Country of Origin', the role of CIBJO, the permanency and stability of treated gemstones, and Nina Gold asks the question 'What is the real price of a gemstone?'

There is an awful lot to digest but we hope you will find it both informative and eye-opening. Awareness is your best tool when dealing with lab-created and treated gemstones, so please use it!

Finally, Project Africa is about to be launched here in Ethiopia. A game-changer for the World Gem Foundation and Africa in general.

Happy Holidays to one and all. See you in the New Year.

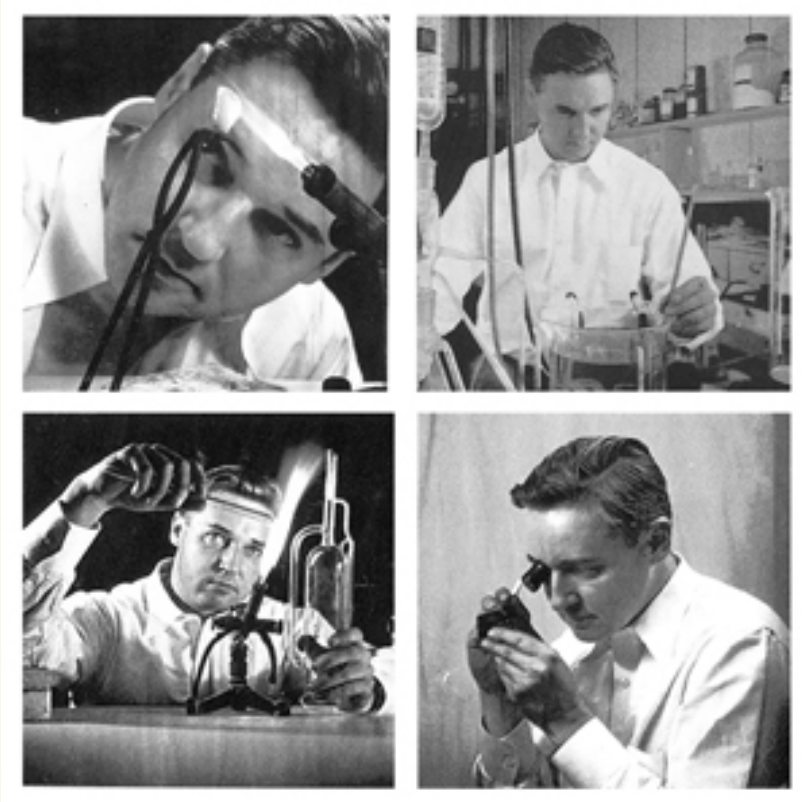
Associate Editor at Work

FEATURE interview

Meet Tom Chatham

Who is Tom Chatham?

I was born November 9th, 1945 and just turned 77. I went to the University of California in Santa Cruz, majoring in Math and chemistry. I did not graduate but used my 2+ years to cram in the majors while skipping the humanities and other courses I felt were a waste of time and energy. I had always worked growing up, delivering newspapers at 4 am before school at 14, working in a gas station, selling Christmas decorations around that season. Growing up, I learned that if you wanted something and your parents were not likely to buy it for you, you earned the money to do so. This was highly irritating to my parents because I bought a motorcycle, then a car before I was 16, the legal driving age. I worked on them in our garage. I wanted to work, not go to school.



What was it like growing up with Carroll Chatham as your father?

Growing up with my father was not much fun. He always worked late and I was off to school before he got up in the morning. Weekends meant nothing to him because his work in the labs required constant over site on a daily basis. Usually if I did see him, it was because I was in trouble and my mother asked for his assistance. Once out of college I was prepared to either apply at United Airlines as a mechanic or work for my father. He never had any employees. This was 1965. He hired me but insisted I become an independent contractor because he hated all the employee rules our government required. This was a blessing in disguise because it gave me all sorts of write offs at tax time.

Why did you choose to follow in your father's footsteps?

I really had no idea what my father did except he made emerald and was famous for it. In my younger teens I met many people who came to interview him, or try to buy him out or shake him down. Anyone who got an audience with my father did so in our very common house in San Francisco because no one was allowed into the labs, so our living room was his office for meet and greet occasions. This was a tremendous learning experience for me. Although I was not allowed to speak, I learned how you should handle top executives and how my father could just say, 'that's none of your business' if questions got out of line.

Initially, I was not even allowed in the growing part of the labs. I cleaned equipment and learned that everything we utilized, was fabricated in our own shop by my father. Under his direction I learned how to weld exotic metals like platinum we used for crucibles, how to build a furnace capable of maintaining + or - one degree C at 1200C and be safe enough to touch on the outside. Our furnaces were an invention in themselves. Over the years I became more and more involved with the chemistry of our

Chatham rubies, sapphires and emeralds

work and it was a great experience for me and him as we developed a growing respect for each other's talents. Carroll Chatham was a gifted scientist that I would never grow into. I, on the other hand, became better than him at fabrication and doing the dirty work in the labs. I soon discovered I also had a knack with marketing he did not have and was sorry that was not my college major. We didn't need another chemist in the labs…we needed a marketer which I became over the next 15 years.

What has been your greatest challenge in getting the industry to embrace lab-created gemstones?

Believing what we said was true. We don't make fake emerald, it is emerald! Natural emerald dealers hated us and hated the ads I created, some purposely to irritate them! Because of natural emerald dealers in New York, we had to fight the Federal Trade Commission in Washington DC for three years. The dealers wanted 'synthetic' and nothing else. We refused. We eventually won the case and that's where 'created' came from. The term 'synthetic' has many definitions and most of them are negative. Synthetic oil in not structured like natural oil. There is no 'natural' nylon in the earth, synthetic rubber or leather does not resemble the structure of the natural counterpart it copies. Finely, the GIA has stopped using the word 'synthetic' because of the confusion. However, ask anyone from De Beers what we grow and all you will get is 'synthetics', not even synthetic diamond!

We had talked ten years ago about the use of the word 'synthetic'. What is your aversion to using it to describe lab-created gemstones?

Too many definitions and even the GIA has proclaimed it dead.

Chatham Jewellery

Your father originally tried to recreate the failed diamond-growing experiments of French chemist, Henri Moissan. What emotions did you feel when you finally produced lab-created diamonds in 1993?

A feeling of accomplishment to my father's life's work. I have many notes of my father's theory of diamond growth and most were very close. We just didn't have the equipment to accomplish it. What surprised me was how many people were very upset when I made my announcements of growing white diamond in 1996. Richard Liddicoat told me I shouldn't do it. Martin Rapaport said I could be stopped! I never figured out what he meant but it never materialized. He is not a fan but no one had tried to kill me either…yet. Making the diamond was truly the holy grail of crystal growth. There is nothing left to invent (or worth inventing I should say).

Why do you feel Chatham succeeded when so many others failed in the production and marketing of lab-created gemstones?

Being first in any field is extremely important. When Pierre Gilson announced his Emerald in the mid 60's it was no big deal, just another Chatham Created Emerald to deal with. Same with Kashan Ruby, Ramura ruby, the list goes on and on of failed products similar to Chatham but we were always first, and we were in the jewelry business and in the USA. Another aspect of our success was our willingness to help the trade understand our gemstones. I have given thousands of stones away for research and have always supported good gemology and gemologists because if they are afraid of what we do, like Kashan used to boast, 'I can fool even the best gemologist', it turns the trade against you, not for you.

What ran through your mind as a business-person when the earthquake hit San Francisco on October 17th, 1989?

This is gonna cost us a huge bundle of cash!! I was in the labs within 30 minutes of the quake. All power in the city was shut down to protect against fires which almost destroyed San Francisco in 1906. It was fire not quakes that demolished the city in 1906. We did not have a generator and every generator for miles was sucked up by hospitals and other much more important businesses. We immediately began to empty over 100 furnaces at various stages of growth. We needed to get the flux away from the growing crystals because when the fluxes cool, the chemistry changes and a cancerous growth will ruin the crystal surfaces. When the fluxes cool to a solid, nothing happens except the volume shrinks. But when you get power back on,

the fluxes expand from the bottom and in most cases, breaks the crucible. We could stand 4 hours without power. We were off for weeks! In the following weeks I explored all avenues of options; buy a big generator, get insurance, roll the dice again or move. The first option was the best but very problematical. The generator required an 18 wheel trailer, diesel storage and to be run on line every two weeks! We had no storage for the generator or the diesel and diesel rots if not used. We could, in an emergency, put the generator on the sidewalk and even feed our neighbors but not all year long.

Carroll Chatham


Chatham family

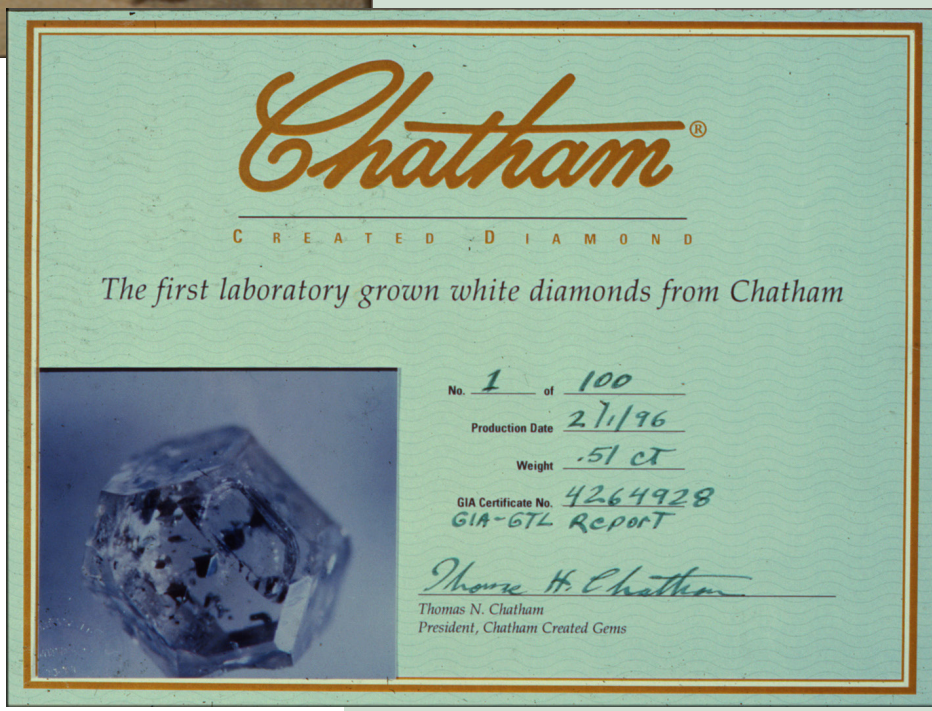
The second, insurance, was out because this was 'an act of God' so no coverage. So we decided to do what my father had always done, be self-insured and roll the dice. I also decided to expand overseas to minimize our losses. This we have done.

Tell us about the 'Giving Back' program that Chatham initiated?

This was a program instituted by Harry Stubbert (now President of Chatham) and Monica McDanials (Head of marketing at Chatham.) We have a 'Save the Elephants' program which we heavily donate to and a 'Save the Earth' program that plants a small tree for every stone sold! I am a little fuzzy on this but it's good and a pay back.

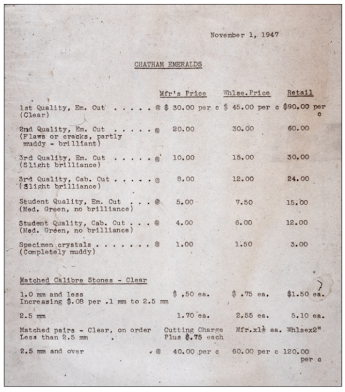
Is it time to kick back and enjoy life or are you still driven to achieve more in the gem industry?

No kicking back….I am in Mexico right now answering your request! I am involved in new projects, especially diamond, and now new cutting experiments in India. I don't have anything to do with daily operations now and don't go in the office but my lap top is never far away. There is no 'retirement' in this business until you die!



Chatham Grown Diamonds

Chatham Grown Ruby



November 1, 1947

CHATHAM EMERALDS

	Mfr's Price	Whles.Price	Retail
1st Quality, Em. Cut (Clear)	@ $ 30.00 per c	$ 45.00 per c	$90.00 per c
2nd Quality, Em. Cut (Flaws or cracks, partly muddy - brilliant)	@ 20.00	30.00	60.00
3rd Quality, Em. Cut (Slight brilliance)	@ 10.00	15.00	30.00
3rd Quality, Cab. Cut (Slight brilliance)	@ 8.00	12.00	24.00
Student Quality, Em. Cut (Med. Green, no brilliance)	@ 5.00	7.50	15.00
Student Quality, Cab. Cut (Med. Green, no brilliance)	@ 4.00	6.00	12.00
Specimen crystals	@ 1.00	1.50	3.00
Matched Calibre Stones - Clear			
1.0 mm and less Increasing $.08 per .1 mm to 2.5 mm	$ .50 ea.	$ .75 ea.	$1.50 ea.
2.5 mm	1.70 ea.	2.55 ea.	5.10 ea.
Matched pairs - Clear, on order	Cutting Charge Plus $.75 each	Mfr.x1½ ea.	Whlesx2 ea.
2.5 mm and over	@ 40.00 per c	60.00 per c	120.00 per c

Carroll's first price list, 1947.

The end of World War II released Carroll from his obligation to work at the canning plant and he couldn't get out quick enough. He was probably a lousy employee anyway, because he was always thinking about his other job: how to grow emeralds. He told his boss, "I am here to announce my resignation from this company from this day forward. Unfortunately, the meager salary I am paid will not cover my income taxes I owe from other earnings!" His boss was upset but could do little about it.

Carroll worked full time constructing his laboratory on 14th St. and by 1946-47, it was in full production growing emeralds. Many newspaper articles were written about his endeavors and magazine writers were constantly beating on his door.

A 1947 Fortune magazine article on my father was the inspiration for another crystal grower, Pierre Gilson. According to his son, Pierre Jr., the article inspired Gilson's search for growing his own emeralds.

Many people complimented Carroll on his accomplishments, but some condemned him. One person suggested that he was a German spy who had stolen notes from the I.G. Farben Company in Germany, where they were trying to grow emerald during World War II. Another accusation came out of Europe, calling Carroll Chatham a fraud. The FBI came around and asked questions, since we had just beat Germany in the war and people were very sensitive to anything connected to Nazism. It was easy to verify my father's years of research, his history of accomplishments – not to mention the fact that he had never left the United States in his life. That was easy to prove.

Not so easy was overcoming the threat many perceived Carroll's discovery could mean to their jewelry and gemstone livelihoods.

SYNTHETIC EMERALDS: NEW 1948 SECRET. In his San Francisco laboratory, Chatham displays mass of freshly-harvested emeralds, which are better in some respects than nature's. Chatham's emeralds retail for around $90 a carat. Gems worth $100,000 might be cut from these stones; as many natural gems might cost $1,000,000. Commercial production begins this month.

Carrall Chatham featured here in *Science illustrated*, 1948. Showing mass of freshly-harvested emeralds. By Frederick H. Pough. Photographed by Jon Brenneis and David B. Eisendrath, Jr.

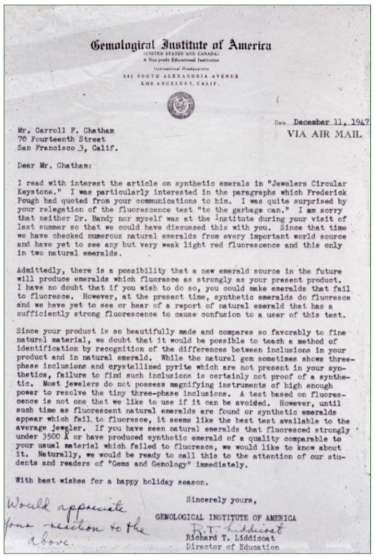
Portrait of Richard T. Liddicoat at his desk, taken Spring 1946. Image courtesy of GIA.

"Since your product is so beautifully made and compares so favorably to fine natural material, we doubt that it would be possible to teach a method of identification by recognition of the differences between inclusion in your product and in Natural emerald."

Richard T. Liddicoat,
Director of Education.
Gemological Institute of Amerca.

December 11, 1947

To: Mr. Carroll F. Chatham
70 Fourteenth Street
San Francisco 3,
California.



Gemological Institute of America

541 SOUTH ALEXANDRIA AVENUE
LOS ANGELES, CALIF.

Dec. December 11, 1947
VIA AIR MAIL

Mr. Carroll F. Chatham
70 Fourteenth Street
San Francisco 3, Calif.

Dear Mr. Chatham:

I read with interest the article on synthetic emeralds in "Jewelers Circular Keystone." I was particularly interested in the paragraphs which Frederick Pough had quoted from your communications to him. I was quite surprised by your relegation of the fluorescence test "to the garbage can." I am sorry that neither Dr. Eandy nor myself was at the Institute during your visit of last summer so that we could have discussed this with you. Since that time we have checked numerous natural emeralds from every important world source and have yet to see any but very weak light red fluorescence and this only in two natural emeralds.

Admittedly, there is a possibility that a new emerald source in the future will produce emeralds which fluoresce as strongly as your present product. I have no doubt that if you wish to do so, you could make emeralds that fail to fluoresce. However, at the present time, synthetic emeralds do fluoresce and we have yet to see or hear of a report of natural emerald that has a sufficiently strong fluorescence to cause confusion to a user of this test.

Since your product is so beautifully made and compares so favorably to fine natural material, we doubt that it would be possible to teach a method of identification by recognition of the differences between inclusions in your product and in natural emerald. While the natural gem sometimes shows three-phase inclusions and crystallized pyrite which are not present in your synthetics, failure to find such inclusions is certainly not proof of a synthetic. Most jewelers do not possess magnifying instruments of high enough power to resolve the tiny three-phase inclusions. A test based on fluorescence is not one that we like to use if it can be avoided. However, until such time as fluorescent natural emeralds are found or synthetic emeralds appear which fail to fluoresce, it seems like the best test available to the average jeweler. If you have seen natural emeralds that fluoresced strongly under 3500 Å or have produced synthetic emerald of a quality comparable to your usual material which failed to fluoresce, we would like to know about it. Naturally, we would be ready to call this to the attention of our students and readers of "Gems and Gemology" immediately.

With best wishes for a happy holiday season.

Sincerely yours,

GEMOLOGICAL INSTITUTE OF AMERICA
R.T. Liddicoat
Richard T. Liddicoat
Director of Education

Would appreciate your reaction to the above

"Would be appreciate your reaction to the above, with best wishes for a happy holiday season. Sincerely yours,"

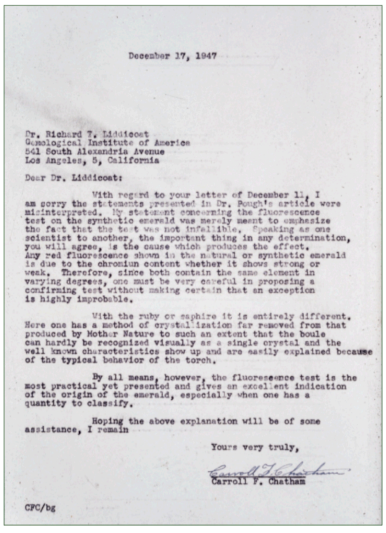
Carroll F. Chatham, in his office, examined a lab-grown emerald.

"By all means, however, the fluorescence test is the most practical yet presented and gives and excellent indication of the origin of the emerald, especially when one has a quantity to classify."

Carroll F. Chatham.

December 17, 1947

To: Dr. Richard T. Liddicoat,
Gemological Institute of Amerca.
541 South Alexandria Avenue,
Los Angeles 5, California.



December 17, 1947

Dr. Richard T. Liddicoat
Gemological Institute of America
541 South Alexandria Avenue
Los Angeles, 5, California

Dear Dr. Liddicoat:

With regard to your letter of December 11, I am sorry the statements presented in Dr. Pough's article were misinterpreted. My statement concerning the fluorescence test on the synthetic emerald was merely meant to emphasize the fact that the test was not infallible. Speaking as one scientist to another, the important thing in any determination, you will agree, is the cause which produces the effect. Any red fluorescence shown in the natural or synthetic emerald is due to the chromium content whether it shows strong or weak. Therefore, since both contain the same element in varying degrees, one must be very careful in proposing a confirming test without making certain that an exception is highly improbable.

With the ruby or sapphire it is entirely different. Here one has a method of crystallization far removed from that produced by Mother Nature to such an extent that the boule can hardly be recognized visually as a single crystal and the well known characteristics show up and are easily explained because of the typical behavior of the torch.

By all means, however, the fluorescence test is the most practical yet presented and gives an excellent indication of the origin of the emerald, especially when one has a quantity to classify.

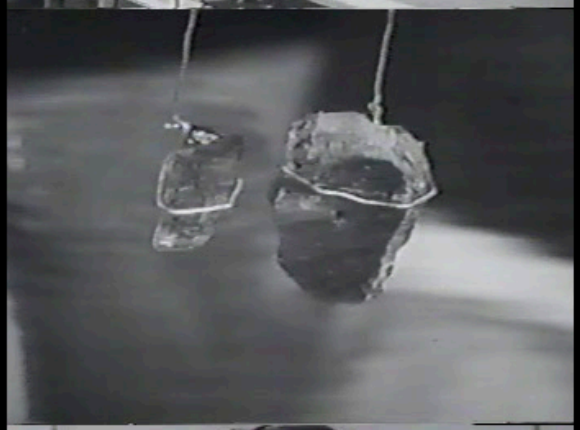
Hoping the above explanation will be of some assistance, I remain

Yours very truly,

Carroll F. Chatham

CFC/bg

"Hoping the above explanation will be of some assistance, I remain yours very truly,"



"You Asked for It," hosted by Jack Smith, had my father on for a live interview in 1955. This program was very popular, on a par with "60 Minutes," and someone from Topeka, Kansas wrote and asked: "Is there really a man in San Francisco who can grow real emeralds crystals?"

Carroll Chatham - You Asked for It

Chatham Emeralds

Cubic Press
to create
Diamond powder

Crucible

Grown Diamonds

Carroll Chatham 1937

First 100 grown Diamonds

COUNTRY of origin

Romancing the Stone

When we talk about treatments and enhancements, our attention immediately focuses on heat treatment, irradiation, glass-filling, and diffusion (both surface and sub-surface). We do not necessary think of one of the biggest 'enhancements', Country of Origin.

The subject of country of origin is a controversial and contentious one and while many discount its importance arguing that all gemstones should be judged solely on their colour (hue, tone, and saturation) and clarity, the added value a particular locality bestows on a gemstone cannot be ignored.

Certainly, it can be argued that while gemstones are found in certain geological formations, they were formed long before borders were established and in some cases those borders have changed over the years due to territorial disputes. This is certainly true in the case of alluvial deposits where gem materials may have travelled hundreds of kilometres, conceivably originating in one country but being mined in another.

On the other hand, if we are going to 'add value' to a gemstone based on its country of origin, how can we prove beyond a reasonable doubt where the gemstone originated?

While this is often possible with certain rubies, sapphires, and emeralds due to the presence of unique internal features that are representative of a particular geological environment

it is impossible with diamonds unless they are accompanied by 'chains of warranties' that provide provenance as to where they were mined.

Known as the 'Kimberley Process Certification Scheme (KPCS)' and adopted by the United Nations General Assembly under Resolution 55/56 in 1993, it was designed to prevent 'blood' diamonds from entering the mainstream through the rough diamond markets and assure consumers that by purchasing certified diamonds they were not financing war and human rights abuses.

A similar system was adopted and implemented by the Canadian government to protect the Canadian diamond industry and evolved from the collaborative efforts of a broad cross section of the industry including the diamond-mining sector, cutters and polishers, retailers, the Canadian Jewellers Association, Jewellers Vigilance Canada as well as the Royal Canadian Mounted Police and other government stakeholders. Known as the 'Canadian Diamond Code of Conduct', it states:

'Canadian diamond stakeholders are committed to ensure that diamonds represented as Canadian can be authenticated to protect themselves against deceptive practices that may erode consumer confidence and at the same time ensure compliance with the Competition Act'.

The 'Code' establishes a minimum standard required to validate a Canadian diamond claim based on a paper trail and a chain of warranties and has been endorsed by the Competition Bureau and the World Jewellery Confederation (CIBJO).

Does this initiative work? Well not really. I know from personal experience that over the years I encountered numerous diamonds that had been certified as Canadian, yet they had been certified by GIA up to three years prior to their Canadian certification. Clearly, they were not Canadian because the Canadian certification mark should have pre-dated the GIA laser inscription. At that time, Canadian diamonds were selling at a premium (Rapp plus 15%) so it was hardly surprising that some benefited from this fraudulent practice.

This practice of attaching 'labels' to gemstones to add either real or perceived value is not new and certainly not exclusive to the diamond industry. Coloured gemstones, most notably rubies, sapphires, emeralds, and tourmalines are often sold using historically important gem localities such as Burma (Myanmar), Kashmir (India), Colombia and now Paraíba (Brazil) to enhance the sale.

If the country of origin can be proven and the stone is certified by a recognized laboratory, the financial rewards can be enormous.

Burmese Ruby (Photo by Tino Hammid)

The following charts illustrate the affect 'origin' can have on three-carat rubies, blue sapphires, emeralds, and tourmalines from different localities.

GEMSTONE	COUNTRY	4	6	8	10
RUBY	*Myanmar (Burma)*	+85%	+80%	+206%	+138%
	Mozambique	Base	Base	Base	Base
BLUE SAPPHIRE	*Myanmar (Burma)*	+25%	+28%	+38%	+67%
	Sri Lanka	Base	Base	Base	Base
EMERALD	*Colombia*	+78%	+20%	+36%	+33%
	Brazil	Base	Base	Base	Base
TOURMALINE	*Paraíba (Brazil)*	+5900%	+8900%	+15172%	+10733%
	Non-Specific	Base	Base	Base	Base

REFERENCE: GemGuide November / December 2022

RUBY OR PINK SAPPHIRE?

I am often asked what is the difference between a ruby and a pink sapphire? Some will tell you it is dependent on whether you are buying or selling. If you are buying, it is a pink sapphire. If you are selling, it is a ruby. Certainly, the huge differential in prices would support this logic.

According to GemGuide (November / December 2022), a mid-range (GemGuide 6) three-carat heat-treated non-origin specific ruby would sell for 337% more than a similar quality heat treated pink sapphire. If the same stone were 'Extra-Fine', the price differential would jump to 425%.

If the same rubies were from Myanmar (Burma) and were unenhanced, these percentages would jump to 1500% for mid-range quality to a staggering 2275% for 'Extra-Fine'.

While the GIA established the following guidelines, it is clear that like 'Country of Origin', the rules will always be 'bent' in order to make more money. This is not unique to the gem industry; it happens all the time with other products. However, since it is prevalent and we know it is happening, why do we create these opportunities that facilitate fraudulent practices?

Personally, I do not care where a gemstone comes from. If we have two stones that are identical in quality, they should be priced the same. Human intelligence is not based on the colour of skin, where we come from or what religion we follow. It is based purely on an individual's knowledge. Are all Colombian emeralds superior to those from Zambia? Absolutely not. So why is origin used as a 'yardstick' for determining value?

I know many of you will disagree with my logic. You will argue that 'origin' is ingrained in the psyche of the gem industry and we should not change the playing

field, but is this 'logic' skewed by the fact that gemstones from certain localities are better than gemstones from other parts of the world or merely by the fact that these 'labels' make us money?

If we cannot categorically confirm where a gemstone comes from, how can we use this as a 'Valuing' factor? Since origin is not used in the pricing of diamonds (with the exception of Canadian diamonds), why do we factor it in when we discuss coloured gemstones?

Gemstone	Hue	Tone	Saturation
Ruby	Orange/RED	5 – 8	4 – 6
Ruby	RED	5 – 8	3 – 6
Ruby	Slight Purplish/RED	5 – 8	3 – 6
Ruby	Strong Purplish/RED	5 – 6	6
Pink Sapphire	RED	2 – 5	1 – 6
Pink Sapphire	Slight Purplish/RED	2 – 4	1 – 6
Pink Sapphire	Strong Purplish/RED	2 – 4	1 – 6
Pink Sapphire	PURPLE/RED – RED/PURPLE	2 – 4	1 – 6
Pink Sapphire	Reddish/PURPLE	2 – 4	1 – 6
Pink Sapphire	PURPLE	2 – 4	1 - 6

I have always discouraged 'discounting' because to me it is a never-ending downward spiral. Someone somewhere will always sell an item for less. If price is an issue, offer them alternatives that appear the same but cost less. For example, if a client wants a D Flawless one-carat diamond but price is an issue, show them an E VS-2. This will shave almost 50% from the price and yet the client (and even a professional grader) will not see the difference with the unaided eye if the 'cut grade' is the same.


Blue Sapphire (Kashmir) (Photo by Tino Hammid)

As I write this article, I am preparing two lectures this week in Addis Ababa, Ethiopia. My research revealed that a five-carat unenhanced Burmese 'Extra Fine' ruby currently sells for more than $ 500,000 USD (at wholesale) than a non-origin specific heat-treated ruby of the same quality. Both will look the same, but one will leave a sizeable hole in your pocketbook. If you see 'added value' in spending this 'premium', fine, but I can assure you that unless you are talking to a professional gemmologist, no-one will understand this 'added value'.

As British Gemmologist Beth West wrote in a GCS LinkedIn post:

'What needs to happen now is for 'origin' on a report to be reassigned, not to quality, but to the reality attached to that place name.

Origin should not instruct the consumer as to the value of the gem. It should instruct them on the nature of that locality: What is it like? What is its history, its culture? How have gemstones played a part? Whose hand was the first to hold that gem now in their possession?

This is the way gemmological education should be re-directed.

It would make origin a far more powerful and valid tool'

How true!

CHANGING LIVES THROUGH AFFORDABLE GEMMOLOGICAL EDUCATION IN THE KEY GEM PRODUCING AREAS

Project
AFRICA

POWERED BY THE WORLD GEM FOUNDATION

SCHOLARSHIPS

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 2023, 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, 2022. 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.

W.E. Hunn Memorial Gemmological Scholarship

Each recipient of the Tino Hammid Memorial Gemmological Scholarship will also automatically receive the W.E. Hunn Memorial Gemmological Scholarship that will provide funding equivalent to 50% of the cost of the practical workshops and final examinations.

To download the application form, please click on the image

APPLY NOW!
SCHOLARSHIP
APPLICATION

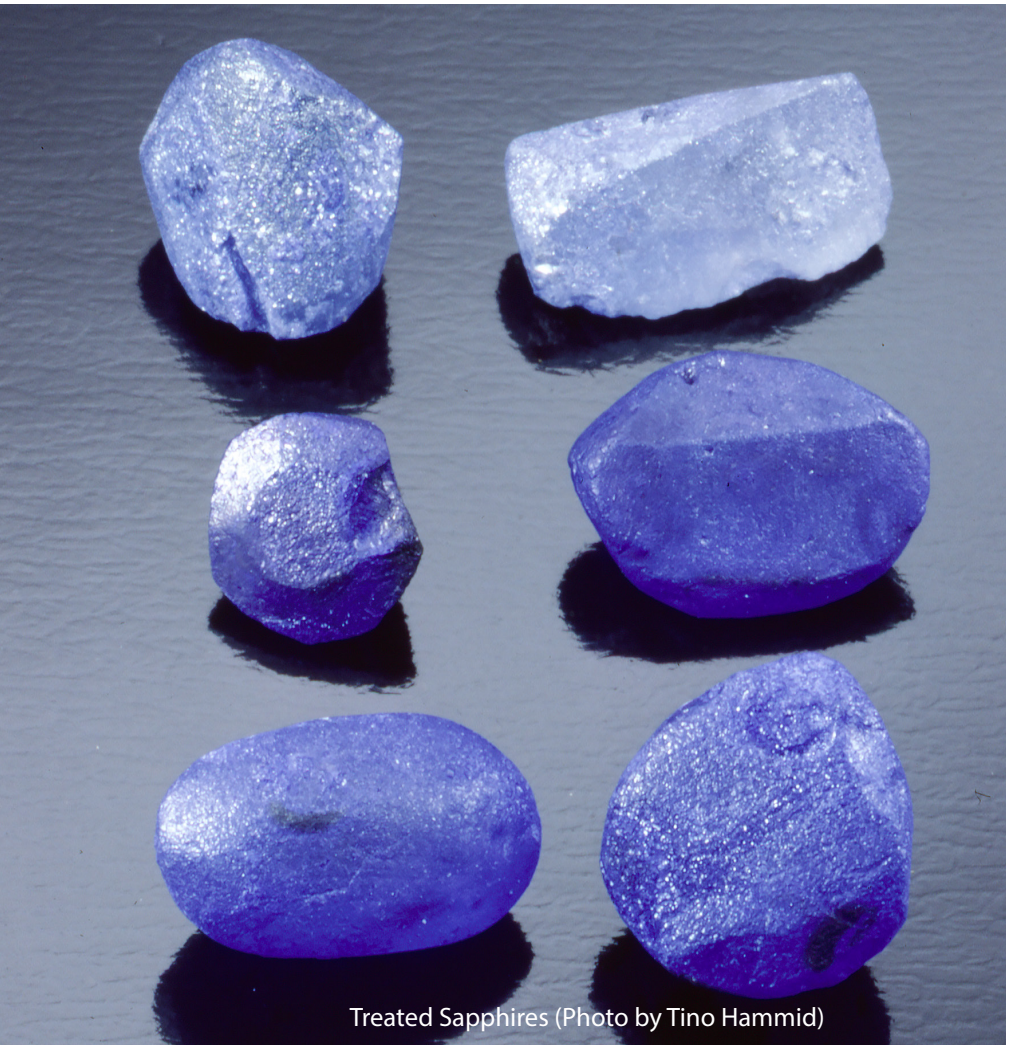
POINT

Nature and Science Working Together

The use of various treatments to improve the appearance of gemstones is not new. We find evidence of treatment in antique jewels, and ancient writings - from Roman times - attest to a long-standing knowledge of ways to improve the appearance of many gemstones. What is new, (relatively speaking) is the routine use of treatments, which began in the 1960s, necessitated by an ever-declining supply of natural, fine-quality gemstones.

Some treatments simply continue the process that Mother Nature started. All gems are exposed to heat, and many to radiation, as they are forming in nature. Today, most rubies, sapphires, and many other gemstones are routinely treated with heat or exposed to some type of radiation to change or enhance their color and improve clarity, and pricing is based on the assumption that enhancement has occurred. On the other hand, if the color of a gem is very fine, and if it can be documented by a respected gem-testing laboratory that the color is natural and that there is no clarity enhancement, the stone will command a much higher price because such stones are so rare and desirable.

The allure of natural, colored gemstones is as old as time. Humankind's fascination, however, with finding ways to improve, imitate or duplicate them is also as 'old as time'! So in today's market, buyers find more varieties of gems than ever before, in virtually every color, from more parts of the world than ever envisioned. This is wonderful. However, the picture doesn't stop here. We are also seeing many more synthetic materials (also known as 'lab-grown' or more accurately, 'factory-grown') in addition to new materials such as moissanite and CZ. In addition, and perhaps more serious, is the reality that common gems occurring in colors similar to more valuable gemstones are being misrepresented and sold as something more valuable. This is nothing new.



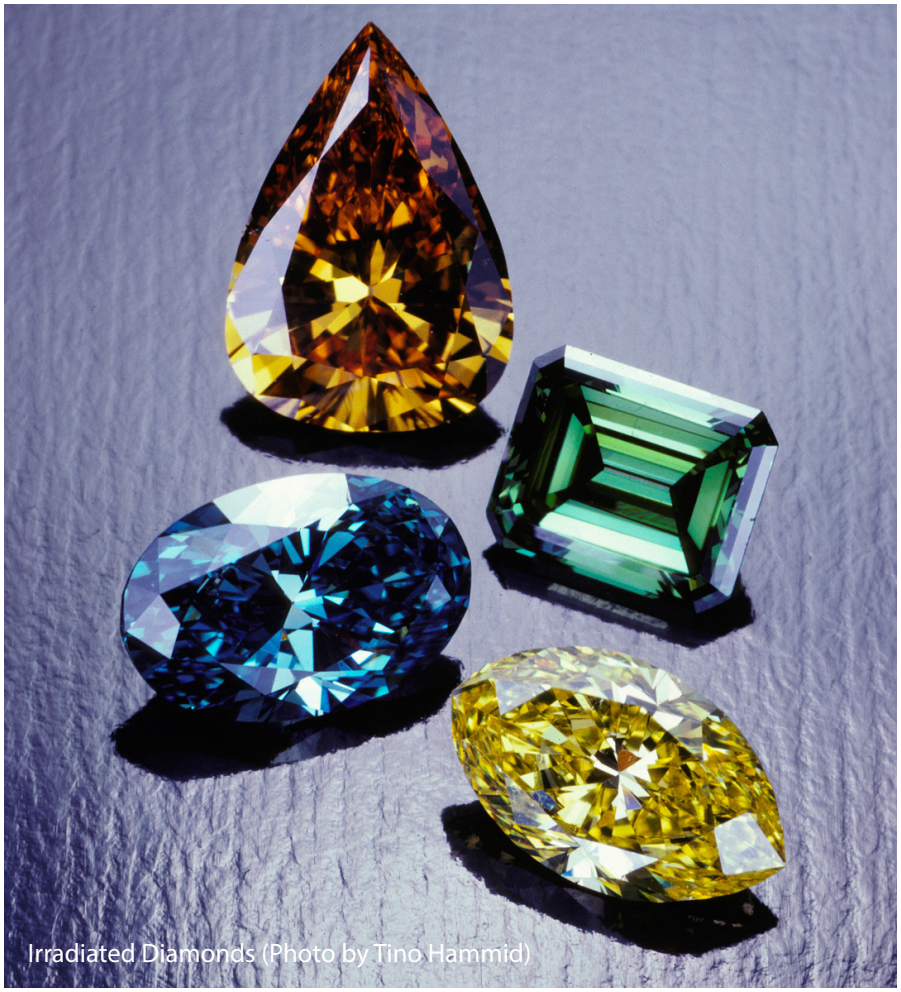
Treated Sapphires (Photo by Tino Hammid)

What is new, relatively speaking, is the introduction of a variety of treatments to improve the appearance of naturally occurring gems, resulting in having more lovely gemstone alternatives available in the market, many at a greatly reduced cost compared to the cost of a comparable gemstone that has not been treated.

For me, the presence of 'treated gems' is not a bad thing at all, but rather, just the reverse. I see the ability to transform natural gemstones, through various treatments, into more beautiful,

more readily available, and less expensive gemstones (often MUCH less expensive) as a definite plus! For me, they represent a lovely example of nature and science working together…and perhaps even more important, it gives everyone a larger number of choices. Depending on their stage of life, their own values, the particular event they are commemorating, we can all mark the moment with a lovely piece of jewelry…without having to be 'royalty' or mega-wealthy!

As a result of treatments, far more people than ever before in history can enjoy wearing lovely jewelry,



Irradiated Diamonds (Photo by Tino Hammid)

jewelry that people can select based on what they like, what they can afford, the importance of the event or life-cycle moment, and what they want it to symbolize. Jewelry, more than any other "thing," will always re-connect people to a special moment and a wonderful memory…often of something inherently more important than the jewel itself!

Whether buying rough material (that is, in its natural state, as it comes out of the ground) or buying cut and polished gems, there is increasing concern about misrepresentation. Don't be misled into thinking if you are buying 'rough' that you are buying 'natura'; in my opinion, the 'rough' market is more dangerous for the unsuspecting, but that's a topic for another day!

Synthetic material can be subsequently 'roughed up' to look like a natural gem 'in the rough' – I saw a rough dealer, selling ruby rough, in which synthetic material had been roughed up to look like natural 'rough' when it was not natural at all. In this case, only a Chelsea filter was needed to spot it – the natural ruby showed a 'reddish' reaction, but the synthetics mixed in were off-the-chart, super intense red that screamed 'synthetic'! The seller actually laughed and actually told me he wondered why more rough buyers didn't use one. I was shocked, having thought HE didn't know he had synthetics mixed in with what he was selling as 'natural ruby'! When I asked him why he was selling it ALL as ruby, and his exact words were: 'Lady, I buy by the kilo and I sell by the kilo; if someone doesn't know what they're buying, that's THEIR problem!'

The bottom line regarding treatments today is not so much the treatment itself but whether or not it is disclosed, at every step from mine to market!

Unfortunately, as mentioned above, in addition to treated materials, there are also new types of synthetic and imitation materials, creating a technologically more complicated and challenging environment for all buyers. So, while treated gemstones have created a marketplace in which far more people are able to have and enjoy lovely gemstone jewelry, the need to use caution when making any gemstone purchase is also higher than ever!

Given the current possibilities available to anyone buying a lovely gem, being 'treated' is simply another 'choice' and, in my opinion, a far better one that getting other things now being encountered by gem buyers. Treated gems are simply another product being offered…and for many, this is a very good thing!

Whether 'rough' or 'cut and polished', there are a variety of methods used today to enhance appearance:

- heating is routine for many gems such as sapphire and ruby.
- irradiation techniques, such as those used to create blue topaz from common colorless or near colorless material.
- high-pressure/high temperature techniques (HPHT) for whitening 'colorless'diamonds and improving

the color of extremely rare fancy-colors such as blue and pink.

- fillers especially oils of various types, typically used for emerald and increasingly for sapphire and ruby.

The use of heating techniques and various fillers are ages old, dating back to pre-Roman times. Emerald was one of the first gems to be 'filled' to reduce the negative impact of the fractures that are almost always present in this gemstone, and most recently we've seen lead-glass fillers introduced to fill eye-visible fractures in diamonds and to hide fractures in sapphires and rubies. Here again, the issue is not the treatment, but whether or not the seller has disclosed it.

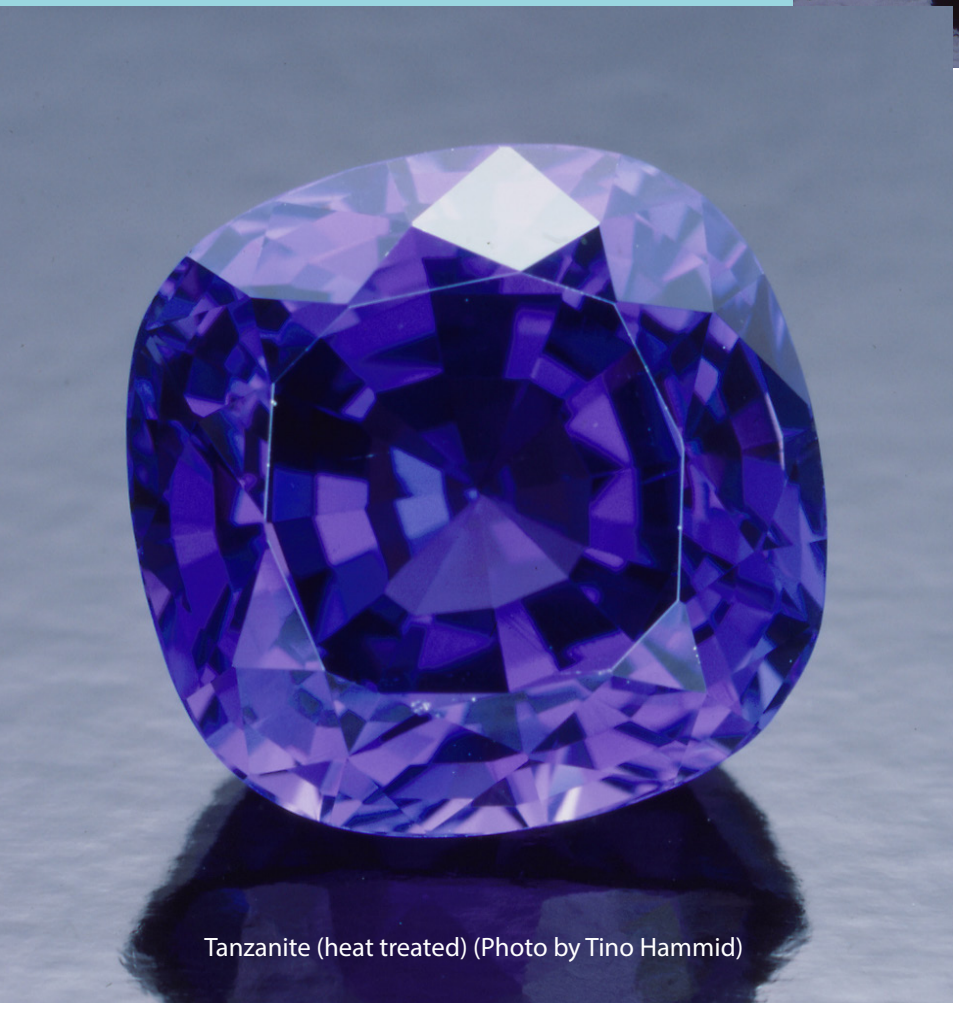
Now to the real question: are treatments 'good' or 'bad'?

In my opinion whether or not 'treatment' is good or bad depends entirely on the sellers, and whether or not they are able to provide the following information:

1) has the treatment been disclosed;

2) how extensively has the treatment been used;

Sugar treated and plastic coated Opals (Photo by Tino Hammid)



Tanzanite (heat treated) (Photo by Tino Hammid)

3) how stable is the treatment;

4) how much does it impact the cost versus the cost of one that is natural;

5) does it reflect the importance of the event for which the gem is given?

In my opinion, anyone buying any gemstone today should ask about each of the '5 factors' above, get their answers, in writing, on their own sales receipt, and make sure you have the necessary information to find them later should you discover that what you bought is NOT what it was represented to be.

ABOUT ANTOINETTE MATLINS, PG, FGA

Antoinette is an internationally renowned gemologist and is the author of the best selling books Jewelry & Gems:

The Buying Guide; Gem Identification Made Easy; Diamonds; Colored Gemstones and many other books about buying and enjoying jewelry and gems.

COUNTER point

The Real Deal

The problem with treated gemstones is that often they are sold as natural stones, and this creates an imbalance in the pricing of gemstones that can cause an undervaluing of untreated stones. For example, a three-carat unenhanced yellow sapphire sells for 67% more than a treated yellow sapphire in an extra fine quality and a three-carat unenhanced pink sapphire sells for 75% more than a treated one (GemGuide November / December 2022). Therefore, if a treated stone is sold as an unenhanced one this could 'skew' the pricing.

One of the key attributes of a gemstone is rarity. This quality has existed since the beginning of time and still exists today. In some cases, natural stones are very rare (fancy red and blue diamonds, ruby, emerald and blue sapphire) and this makes them more desirable.

Courtesy of brgfx / Freepik

For those who believe in the healing qualities of gemstones or their astrological importance, natural untreated gemstones are considered more powerful. Since natural gemstones form over millions of years, they accumulate positive energies, while treated gemstones do not. According to some, a gemstone treated with chemicals often produces negative or opposite results making them 'flawed' for use in astrology.

The Garuda Purana is one of 18 Mahāpurāna texts in Hinduism.The earliest version of the text is believed to have been composed in the first millennium CE, and was likely expanded and changed over a long period of time.

The text is known in many versions, and contains 15000+ verses. Its chapters encyclopedically deal with a highly diverse collection of topics ranging from cosmology, mythology and astrology to how to practice yoga.

The Garuda Purana describes 14 gems, their varieties and how to test their quality. The gems discussed include ruby, pearl, yellow sapphire, hessonite garnet, emerald, diamond, cat's eye, blue sapphire, coral, red garnet, jade, colourless quartz, and bloodstone. The technical discussion of gems in the text is woven with its theories on the mythical creation of each gem, astrological significance, and talisman benefits. [1]

In Chapter 72 (see below), it quotes 'Under no circumstances, a gemstone should be subjected to heating to improve colour and increase brilliance as such gem would bring illness and misfortune to the individual who wears it.' [2]

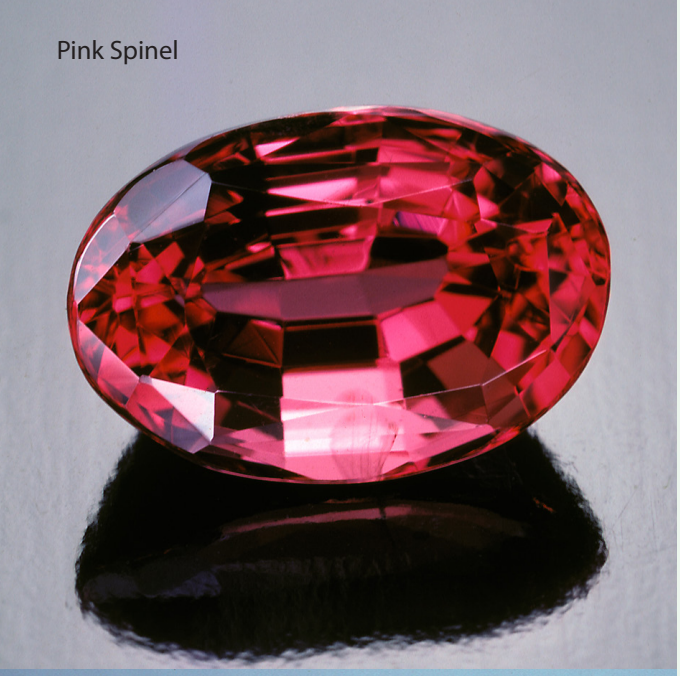
Crystals can also help to bridge the gap with their cleansing potential, helping us to channel our intentions and raise our vibrations in our everyday life.

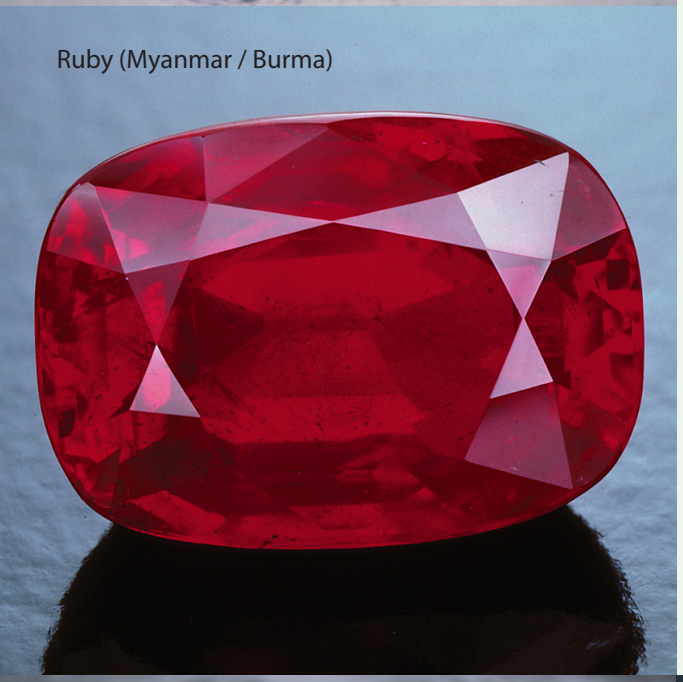
तथापि न परीक्षार्थं गुणानामभि(ति)वृद्धये॥
मणिरग्नौ समाधेयः कथञ्चिदपिकश्चन॥ १२॥
अग्निमात्रापरिज्ञाने दाहदोषैश्च दूषितः॥
सोऽनर्थाय भवेद्धर्त्तुः कारयितुस्तथा॥ १३॥

In all honesty, if a person had the choice, and their finances allowed, they would probably want to own a natural untreated gemstone.

Generally speaking, collectors and connoisseurs of fine gemstones do not want treated or enhanced stones in their collection. Some gravitate to specimens that

Spessartite Garnet (Photo by Tino Hammid)


Pink Spinel


Ruby (Myanmar / Burma)


Pyrope Garnet


Peridot

Photos by Tino Hammid

contain unique and unusual inclusions. To them, the 'natural' factor plays an important role in their decision-making.

Natural gemstones will always command higher prices and will hold their value which makes them more attractive for those interested in investing in gemstones. There are so many treated and enhanced gemstones in the market, and as a result supply exceeds demand and this has a negative effect on their overall value.

If we look at the chart of coloured gemstones and diamonds (2006 – 2022 GemGuide), we can see that stones of fine quality have appreciated in value. Surprisingly, spessartite garnet has outperformed all other coloured gemstones during this time period while emerald, tanzanite and sunstone have underperformed. In the case of diamonds, stones over 1.50 carats have appreciated more than stones of one carat and less.

Another key attribute of gemstones is their durability. While some treated gemstones are considered stable (heat treated) others are not (glass filling).

Finally, we live in a world where image is important, where material possessions become a measurement of our success. For some, there is a certain 'cachet' to owning a gemstone that is untreated. However, this only applies when dealing with individuals who are knowledgeable and understand the difference between treated and unenhanced gemstones.

REFERENCE

1. 'Garuda Purana' Wikipedia

2. https://www.shubhgems.com

Per Carat % Increases (2006 / 2022)

Gemstone (3 carat - Extra Fine)	% Increase
Spessartite Garnet	627%
Pink Spinel	500%
Ruby (Unenhanced Burma)	428%
Pyrope Garnet	300%
Peridot	276%
Pink Topaz	275%
Alexandrite	228%
Paraíba Tourmaline	225%
Ruby (All Origins except Burma)	209%
Rhodolite Garnet	192%
Blue Sapphire (Burma)	173%
Orange Sapphire	167%
Ametrine Quartz	167%
Red Spinel	150%
Purple Sapphire	144%
Red Tourmaline	144%
Pink Tourmaline	125%
Green Tourmaline	122%
Blue / Green Tourmaline	118%
Imperial Topaz	105%
Indicolite Tourmaline	105%
Pink Sapphire	100%
Bi-Colour Tourmaline	100%
Cat's Eye Chrysoberyl	90%
Star Ruby	78%
Golden / Yellow Sapphire	75%
Tsavorite Garnet	75%
Blue Zircon	75%
Amethyst Quartz	67%
Citrine Quartz	59%
Colour Change Garnet	54%
Blue Spinel	50%
Aquamarine	45%
Blue Star Sapphire	44%
Kunzite	39%

Gemstone (3 carat - Extra Fine)	% Increase
Padparadscha Sapphire	37.5%
Madeira Citrine Quartz	33%
Cat's Eye Tourmaline	33%
Spessartite Garnet (Mandarin)	25%
Chrome Tourmaline	20%
Blue Sapphire (All origins except Burma, Kashmir)	6%
Demantoid Garnet	0%
Emerald (All Origins)	-15%
Tanzanite	-15%
Orange Sunstone (Oregon)	-22%

Diamond (Round Brilliant Cut)	% Increase
3.00 carat D / SI-2	76.5%
1.50 carat D / SI-2	46%
3.00 carat D / IF	34%
2.00 carat D / SI-2	31.5%
1.50 carat D / IF	28%
2.00 carat D / IF	27.5%
1.00 carat D / SI-2	24%
1.00 carat D / IF	8%
.75 carat D / IF	7%
.50 carat D / SI-2	1.6%
.75 carat D / SI-2	-7%
.50 carat D / IF	-11%

ABOUT THE AUTHOR

Haimanot Sisay is an Ethiopian gemmologist, a graduate of the World Gem Foundation, an opal cutter, Director of Operations for Project Africa and Associate Editor of Gemmology Today.

REFERENCE: GemGuide 2006 / 2022

PROJECT africa

Update from Ethiopia

MISSION STATEMENT

Project Africa is an initiative by the World Gem Foundation to change lives, to level the playing field, to make gemmological education accessible and affordable to those working in the key gem producing areas. To help them become more knowledgeable about the quality of the products they are producing and their 'true value' on the world market.

It is our belief that everyone deserves the right to live with dignity, to earn a decent living and to be able to provide for their families. Project Africa will change lives, not just today but for generations to come.

ETHIOPIA

Known as the 'Cradle of Civilization', we hope to announce very soon the signing of a joint venture agreement that will see the establishment of our first 'Centre of Excellence' in Addis Ababa in early 2023.

The centre will offer all three World Gem Foundation diploma programs (Career Gemmologist, Coloured Gemstone Professional and Diamond Professional). The complete program will be offered over 25 weeks (750 hours) with students able to take their Coloured Gemstone Professional Diploma in the first 21 weeks and complete their Diamond Professional Diploma in the final four weeks. Students completing both programs will be awarded the World Gem Foundation Career Gemmologist Diploma.

'When Haimanot approached me while completing her practical requirements for her Career Gemmologist Diploma in Mallorca and spoke of her dream to bring gemmological education to Ethiopia and Africa, I knew we had to explore the possibilities. We all know that Africa is the future of the coloured gemstone industry and yet with such mineral wealth, there are relatively few gemmologists. I knew it would not be easy. That others had tried and failed before us but there was something that resonated with me'.

The hunger we have seen here in Ethiopia for gemmological education has reinforced our belief that we are on the right track. The enthusiam and the passion is wonderful to see and I know from discussions we have had that our efforts are appreciated.

Finally, we will start to create a pool of professionals who will have the necessary 'tools' to responsibly manage their gemstone resources and allow Ethiopians and Africans to benefit socially and economically from them.

With plans to open a laboratory, a cutting and a jewellery making centre, we will be able to offer training throughout the entire supply chain. This is important because producers at all levels need to have market options.

MINTEX EXPO 2022

On November 10, 2022, The International Mining and Technology Expo (MINTEX) kicked off at the Millennium Hall, Addis Ababa, Ethiopia.

The expo was held over three days with more than 270 local and foreign companies participating in this international event, including mining companies, jewellery manufacturers and exporters, mining technology manufacturers and importers, financial institutions and the World Gem Foundation all taking part.

The event was intended to directly connect manufacturers with local and foreign buyers.

The participation of foreign mining companies in the expo gave them an opportunity to observe the mining investment opportunities in Ethiopia and engage in mining investment.

The Ethiopian Ministry of Mines and Petroleum, Takele Uma Banti stated that the participation of mining technology manufacturers in this expo will create an opportunity to promote new technological options for the mining sector in Ethiopia.

Minister of Mines and Petroleum Takele Uma Banti

President Sahle-Work Zewde

The opening ceremony was attended also by the Federal Democratic Republic of Ethiopia President, Sahle-Work Zewde, Ministers, Heads of State and invited guests.

Geoff gave a short presentation at the closing ceremonies on Project Africa and how gemmological education can change the current dynamic in Ethiopia and Africa in general.

UNIVERSITY OF SCIENCE AND TECHNOLOGY

On December 8th, 2022, Geoff gave a lecture at the University on Valuing Coloured Gemstones and Project Africa. The lecture was attended by 60 students and professors from the geology department.

Here is what some of the attendees wrote:

'I'm MSc. First year Economic Geology student at Addis Ababa Science and Technology University. I attended the public lecture you gave on ''Valuing of Coloured Gemstones''. I truly have learned a lot from it;

CEO/Founder World Gem Foundation Geoff Dominy

that was a great insight you presented to us. I would like to say thank you for taking your time to come and to share what you have with our country. I really appreciate it!!!

'I greatly appreciate your understanding of the significance and value of the coloured gemstone sector for the economic development of Ethiopia, Africa, and the rest of the world by training skilled gemologists for adding value to Ethiopian raw and finished materials and bringing the world's attention to the amazing potential of the Ethiopian gemstone jewelry industry by offering quality and comprehensive courses, both theoretical and practical. Ethiopia has abundant and diversified mineral resources, including colored gemstones; yet, the country lacks a sufficient number of gemologists'.

'I'm MSc. Second year Economic Geology student at Addis Ababa Science and Technology University. I attended the public lecture you gave on valuing colored gemstones, and I thought you offered us some really insightful information. I want to express my gratitude for taking the time to visit and contribute to our nation. I'm incredibly grateful for it. I have a general understanding of gemstones formation and identification from my background study of geology and I have a keen interest to be a gemologist and work in Ethiopia'.

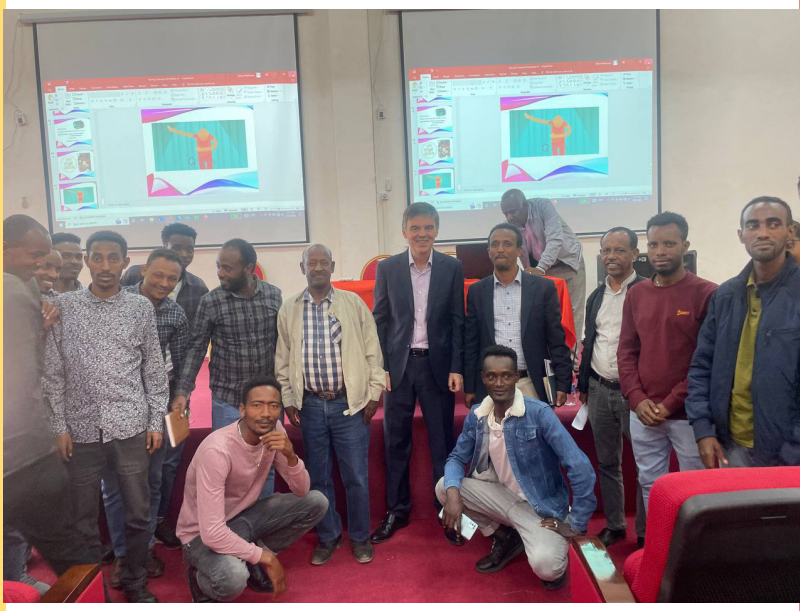
'I graduated last year. I'm the first from my batch with a CGPA of 3.92. Geoffrey, even though I have completed my BSc. with the best grade, I'm not content with my achievement because it is not the thing that I was directly looking for. I wanted to be a gemmologist not only a geologist. I believe it is an opportunity to live my dream. Thanks to you!! I'm very grateful for everything'.

LECTURE AT THE MINISTRY OF MINES

On December 23rd, 2022. Geoff gave a lecture at the Ministry of Mines as part of the Mineral Industry Development Institute Seminar Series along with CEO Tewodros Sintayehu, Founder of Orbit Ethiopia.

The lecture took place in the beautiful lecture hall and was attended by more than 60 people.

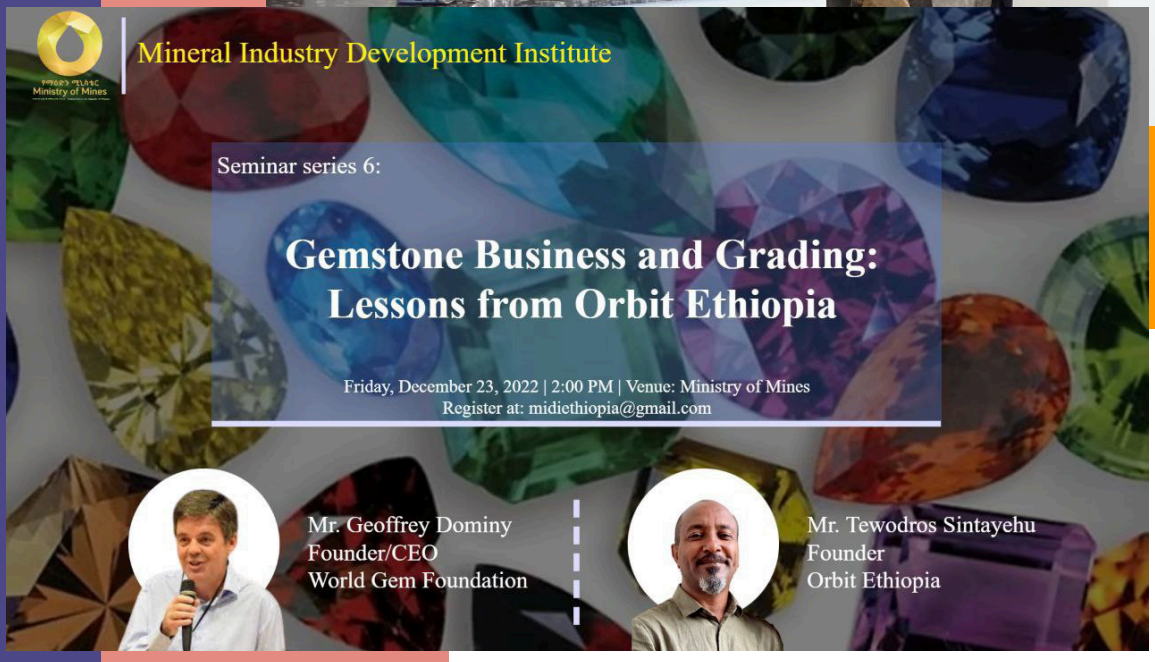
Geoff spoke about the value of gemstones, the supply chain, the grading of coloured gemstones, country of origin and branding. He also emphasized the importance of banning the export of rough, establishing a 'Centre of Excellence' and a laboratory, creating training centres to teach gem cutting and jewellery making, and the advantages of holding an annual trade show and conference and regular gem auctions to stimulate the influx of foreign currency.



Geoff lecturing at the University of Science and Technology in Addis Ababa, Ethiopia

The University of Science and Technology Lecture Hall, Addis Ababa, Ethiopia

Ministry of Mines Lecture Hall, Addis Ababa, Ethiopia



- The identification of red, white and blue gemstones
- Available in English, French or Spanish

Enroll Today!

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 40 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 in gemmology (GIA, Gemewizard, ColourWise, GemDialogue and the World of Color), 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 our online / practical Coloured Gemstone Grading #2 course where you will work with the Gemewizard and ColourWise Colour Grading systems.

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 40 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 online / practical 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 available as a full-time residency program through 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.

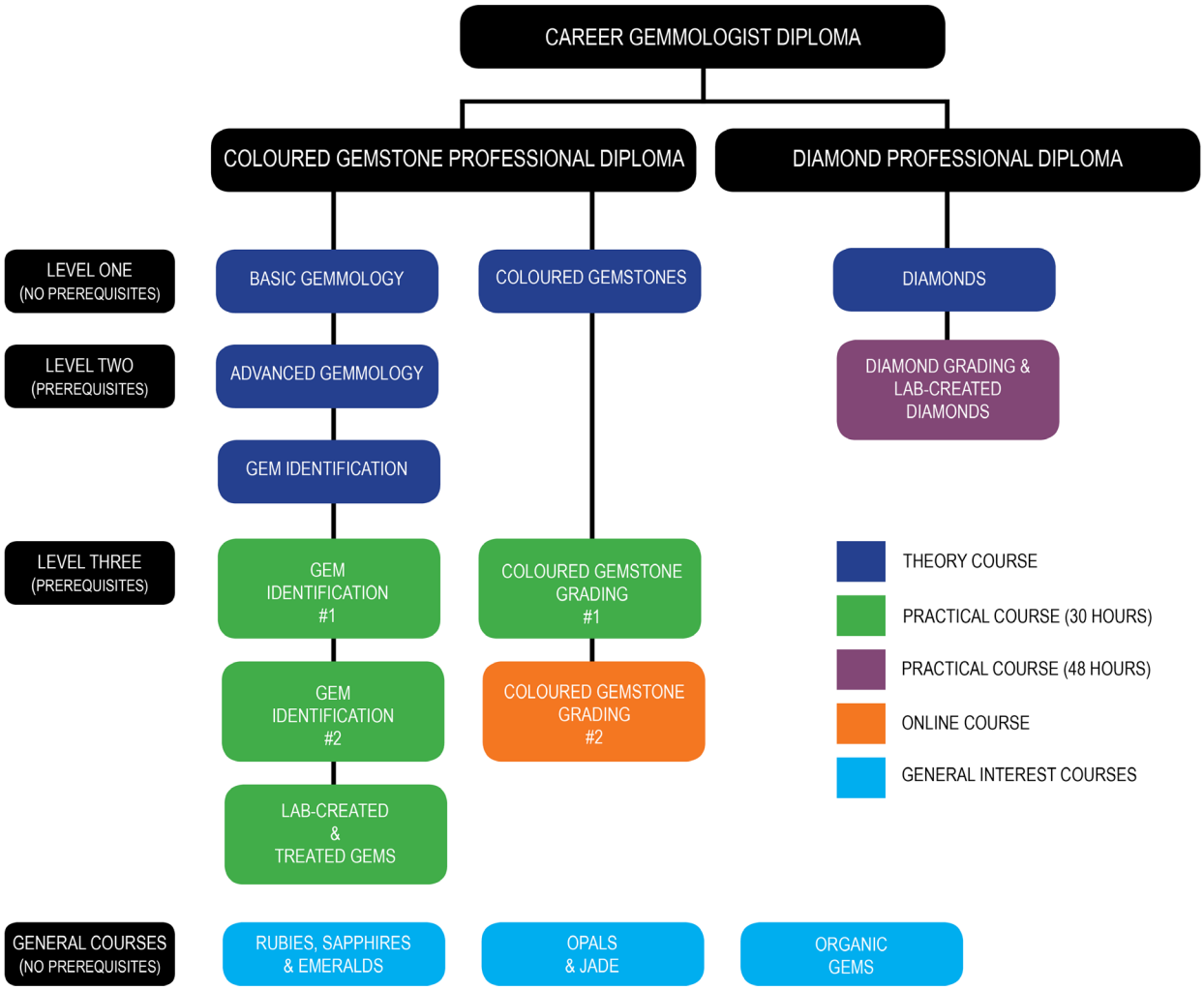
COURSES IN OTHER LANGUAGES

All of our diploma and general interest courses are now available in English, Spanish & French. We are currently translating all the courses into Russian. These will be available in 2023.

Mining and exploration, gem cutting, jewellery manufacturing and goldsmithing, valuations, laboratory work, education and the wholesale/retail trade

GEMMOLOGY OPENS DOORS

Your passport to explore the world, offering diverse and exciting opportunities



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.

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

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.

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. When you purchase the printed course notes, you will automatically receive online access. Since we regularly update all our courses, all course notes are printed on demand.

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.

CAREER GEMMOLOGIST RESIDENCY PROGRAM CURRICULUM

You can download the complete curriculum by clicking here.

Internationally Recognized Diplomas

Practical Workshops

Gemstone Identification #1 (5 Days)

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

Prerequisites: World Gem Foundation Gem Identification (Theory) or equivalent

Gemstone Identification #2 (5 Days)

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

Prerequisites: World Gem Foundation Gem Identification #1 (Practical)

Coloured Gemstone Grading #1 (5 Days)

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

Prerequisites: None

Coloured Gemstone Grading #2 (40 Hours Online)

This online coloured gemstone course consists of a comprehensive overview of the GemeWizard and ColourWise Colour Grading Systems and includes practical exercises that are completed online, glass study samples and a lifetime subscription to ColourWise.

Prerequisites: None

Diamond Grading & Lab-created Diamonds (8 Days)

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

Prerequisites: None

Lab-created and Treated Gemstones (5 Days)

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

Prerequisites: World Gem Foundation Advanced Gemmology (Theory) or equivalent

PROGRAM OR COURSE NAME	EUROS	POUNDS STERLING	USD
CAREER GEMMOLOGY SEVEN			
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
CAREER GEMMOLOGY ELEVEN			
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)	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			
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

PROGRAM OR COURSE NAME	EUROS	POUNDS STERLING	USD
INDIVIDUAL THEORY			
Basic Gemmology	200	180	225
Advanced Gemmology	400	360	450
Gem Identification	225	200	250
Diamonds	225	200	250
Coloured Gemstones	500	450	550
INDIVIDUAL PRACTICAL			
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
EXAMINATION FEES			
Theory / Practical Final Examinations Fees	250	225	280
GENERAL INTEREST			
Rubies, Sapphires & Emeralds	95	85	105
Opals & Jade	75	65	85
Organic Gems	50	45	55

ALL PRICES QUOTED FOR THEORICAL COURSES ARE FOR DIGITAL ACCESS

REMEMBER.....Studying should also be FUN!

TRUE science

Meet Dr. John L. Emmett

Who is Dr. John L. Emmett?

B.S. Physics - California Institute of Technology

Ph.D. Physics – Stanford University

PhD. Thesis under the direction of Nobelist Arthur L. Schawlow

Dr. Emmett is a scientific consultant in high technology areas. Previously he was an Associate Director of the Lawrence Livermore National Laboratory and Director of its Laser Program for sixteen years. He had responsibility for laser physics research and engineering for Inertial Confinement Fusion, Laser Isotope Separation, and Advanced Laser Development, including development and construction of the world's then most powerful solid state laser system (NOVA).

He was a founder of ILC Technology, a founder of Crystal Chemistry and has served as a member of the Board of Directors of Schott Fiber Optics, Inc., and as a member of the Board of Directors of Hoya Corporation USA. He has published extensively in the scientific literature and holds several patents in the fields of lasers and materials. He is currently a consultant to GIA and taught an extensive course on the physics and chemistry of ruby and sapphire to young GIA gemologists. He is currently retired living in Brush Prairie, Washington.

What are your thoughts about treatments and enhancements? The pros and cons?

Gemstone heat treatment has been done for over a thousand years. There is nothing that we can do to stop it. Thus, the pros and cons are essentially irrelevant. It is up to gemologists to continuously upgrade their understanding of the physics and chemistry of gems to be able to recognize when they see something different, and then rapidly figure out and publicize what has been done.

Based on your knowledge of corundum treatments, which treatment do you think is most challenging for gemmologists working in a non-laboratory environment?

I think that low to moderate temperature heat treatment (500 - 1100°C) in ruby where the temperature is low enough to avoid disruption of inclusions, yet high enough to remove or reduce some of the bluish coloration.

What in your opinion is the one treatment that concerns you the most?

Any treatment that is not disclosed by the treater.

Is the industry doing enough to regulate treated and enhanced gemstones?

I don't think so. There are many in this business that want to avoid disclosing some aspects of gem treatment by saying that it has always been done and thus disclosure is not necessary. The fact that the gem dealers are primarily the ones paying the gem labs for reports leads to some tension and raises the question of independence.

Tell us about the Lawrence Livermore National Lab's Laser Program you ran in the 1970s and 80s?

That would require a long book. Bill Krupke and I started there in July of 1972 with the objective of building lasers large enough to study laser fusion. Laser fusion is the idea of using an extremely high-power laser (hundreds of terawatts) with a very short pulse (a few nanoseconds) to ignite a miniature thermonuclear fuel pellet (the hydrogen isotopes deuterium and tritium) to produce energy. This is what happens in a hydrogen bomb where the heat source is not a laser but an atomic bomb. We started with a few dozen people and built the organization to about 1500 in ~12 years and built the largest lasers on the face of the earth. The program has continued after we retired and has recently achieved about 70% of breakeven (thermonuclear energy out/

laser energy in). One more step and I think real energy gain will be achieved. As you can see from my mini bio above, we also initiated several other laser application R&D programs.

Tell us about the work you have been doing to train gemmologists in modern scientific methods and moving gemmology beyond theory to experimentation?

Tom Moses and Ken Scarratt late in 2008 asked me if I would teach a class on the physics and chemistry of ruby and sapphire to a group of six young GIA gemologists from Carlsbad, New York, Bangkok, and Portland. I think that this was the result of the beryllium diffusion debacle in which gemologists had no understanding at all of what happened and why and had no instrumentation to detect it. The class was comprised of 12 sessions, each about two days spread out over 18 months. Overall, it was comprised of nearly 1000 PowerPoint slides. Since then, I have been a consultant to GIA and work with their gemologists on a wide range of topics.

As a researcher, what starts the ball rolling?

For me? It is seeing something that I don't understand. I have an extensive laboratory in my home and lots of corundum samples from many different deposits worldwide. Also, being able to work together with GIA gemologists is really great.

What are your thoughts on 'Country of Origin'? Should it have such a huge impact on the price, or should we simply concentrate on the quality of the gemstone before us regardless of where it came from?

No one **needs** a gemstone. That being clear, then we admit that we only buy them because we love them. Value is generally thought to be determined by 'Beauty', 'Rarity', and 'Durability'. Since we are paying for something, we don't need, we should be the ones that determine value to us of these three factors. We determine beauty as we are the judge of it. Nature determines durability by gemstone type, and we choose the type that we want. Rarity is another matter. If I am presented with two nearly identical rubies, one from Burma and one from Mozambique, I might want to choose the Burma stone for its history and for its rarity. If so, I should be willing to pay more for it, and I am. So, origin can be just as important as beauty for many people.

Now the big question is can we correctly determine the origin? Not definitively. Today origin determination depends primarily on trace element ratio plots and on inclusions. The trace element plots are somewhat problematic because the size of the scatter area from a given location depends to some degree on the number of samples that we have measured. The scatter area for 10 stones may be small, for many more stones, say 100, it is significantly larger. What then about 1000 stones? There are at least that many in the marketplace, but we don't have all that data. While gem labs use these plots there is never been a complete validation even for one single origin.

I really think that any statement of origin must be accompanied by some statement like:

'Given our current data base we think it most likely that it originated in Burma'.

Now the difficulty this creates is the excellent opportunity for the less ethical to push it to the more valuable origin.

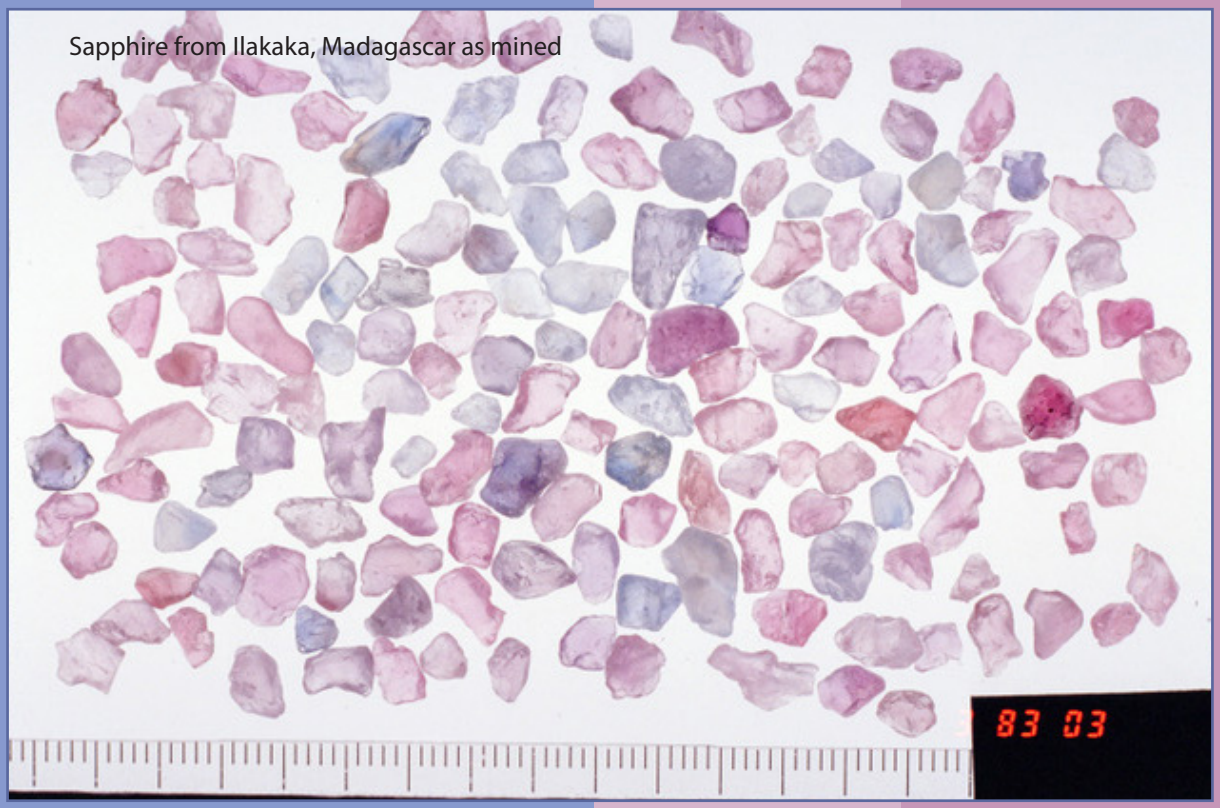
Tell us how you solved the beryllium diffusion treatment of sapphires?

It certainly wasn't just me! A lot of people worked on this as you can see from the authorship of our G&G article of 2003.

Ted Maiman invented the first laser in the spring of 1960. The first laser was a synthetic ruby crystal that is, Cr3+:Al2O3. That initiated much rapid research on lasers. I had a ruby laser operating in the summer of 1961 and continued to work with ruby lasers for the next several years. Synthetic ruby was at that time primarily grown by the Verneuil technique at several different companies. Occasionally, some of the crystals appeared to have a slight orangish coloration and performed poorly as lasers. With improved purity of the starting materials the problem disappeared. It was thought at the time to be caused by Mg, Ti or some unknown color center.

Seeing the orange coloration of Be diffused pink sapphire some 30 years later brought this back to mind. I looked into the diffusion of Mg into sapphire and found that it was far too slow given the diffusion depth that was observed. Then I thought that beryllium was a possibility given that its much smaller ion size would result in faster diffusion. Since there was no published research on Be in corundum, my partner in Crystal Chemistry, Troy Douthit, and I heated various corundum samples coated with aluminum oxide powder containing about 1% BeO, at 1800°C for about 33 hours and received results very similar to the stones coming from Thailand. We then tried alexandrite and beryl as Be sources and got similar results. Then we tried corundum samples from about ten different deposits worldwide of all initial colors which resulted in formation of both yellow and orange coloration. We presented these

results online. It took almost a year for the gemological community to accept these results primarily because of their limited knowledge of crystal chemistry and spectroscopy. Finally, the Thais admitted that this is what they were doing.



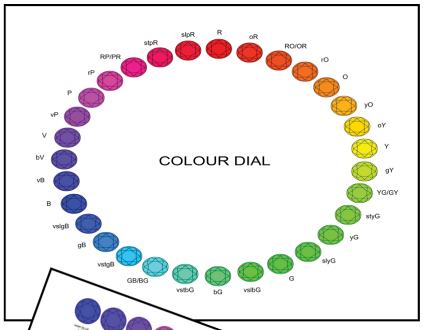
Sapphire from Ilakaka, Madagascar as mined

Sapphire from Ilakaka, Madagascar after Be diffusion at 1800°C, in air for 33 hours. Scale is in mm.

COLOURWISE

INTRODUCING...

The NEXT GENERATION Colour Grading System for coloured gemstones, pearls and jade designed for the International Gem Trade and Industry.



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www.colourwise.info

DISCLOSURE

The Role of CIBJO

The word 'Disclosure' has been used frequently in this issue by Dr. John Emmett, Antoinette Matlins and Haimanot Sisay but how does the gem industry impose guidelines that will protect buyers and the end users?

It is fine to have regulations but unless they are enforceable, they have little value.

Here we look at the role of CIBJO, who they are, what they stand for and the guidelines they have created.


President Gaetano Cavalieri

CIBJO was founded in 1926 as BIBOAH, a European organisation whose mission was to represent and advance the interests of the jewellery trade in Europe. In 1961, it was reorganised and renamed CIBJO. Forty-eight years later, it was reorganised once again and officially named 'CIBJO, The World Jewellery Confederation'.

Located in Switzerland, CIBJO is a non-profit confederation of national and international trade associations including commercial organisations involved in the jewellery supply chain. Currently its membership represents all five continents.

CIBJO state on their website:

'It is the task of CIBJO to record the accepted trade practices and nomenclature for the industry throughout the world. The records of the trade practices complement existing fair-trade legislation of a nation or in the absence of relevant national laws they can be considered as trading standards. In countries where laws or norms exist, which conflict with the laws, norms, or trade practices in other countries, CIBJO will support the national trade organisations to prevent trade barriers developing. The purpose of CIBJO is to encourage harmonisation, promote international co-operation within the jewellery industry, consider issues which are of concern to the trade worldwide and to communicate proactively with members. Foremost amongst these the aim is to protect consumer confidence in the industry. CIBJO pursues all of these objectives through informed deliberation and by reaching decisions in accordance with its Statutes. CIBJO relies upon the initiative of its members to support and implement its standards, and to protect the trust of the public in the industry'.

The work of CIBJO is accomplished through Committees, Commissions and Sectors. Committees and Commissions consider standards for use in the jewellery supply chain. Sectors represent levels of trade in the jewellery industry. Sectors and commissions advise the Executive Committee on current trade practices and issues that affect the jewellery industry.

Three independent sectors exist within the confederation:

Sector A - The Products Sector

Sector B - The Supply Chain Sector

Sector C - The Service Sector

The Executive Committee may appoint Commissions that consider detailed issues. At present these are:

- Coloured Stone
- Coral
- Diamond Ethics
- Gemmological
- Marketing & Education Pearl
- Precious Metals
- World Jewellers Vigilance

The Commissions for Diamonds, Gemstones, Pearls, and Precious Metals have collated the guidelines, which present the accepted trade practices for applying descriptions to these materials. It is in the best interest of all those concerned to be aware of them.

The Sectors and Commissions will propose changes in the standards, also known as the Blue Books, to the Executive Committee. After review, the Executive Committee will submit the accepted proposals for adoption to the Board of Directors and if approved they will notify the assembly of delegates of the changes at the annual congress. Furthermore, it is their mutual responsibility to support these recommendations, which concern all professional people connected with diamonds, gemstones, pearls, and precious metals. CIBJO Standards are subject to government regulations in the respective jurisdictions of CIBJO members.

The national umbrella organisation for each country represents, in principle, all the national trade organisations involved in the sectors mentioned above. This democratic structure, which has contributed to CIBJO's world-wide recognition also includes international trade and commercial organisations, it provides an international forum for the trade to collectively draw attention to issues and implement resulting decisions.

CIBJO BLUE BOOKS

The CIBJO Blue Books are definitive sets of grading standards and nomenclature for diamonds, coloured gemstones, pearls, coral, precious metals and gemmological laboratories, and also responsible sourcing practices. They are compiled and are consistently updated by the relevant CIBJO Commissions, whose members include representatives of trade organisations and laboratories active in the diamond, coloured gemstone, pearl, precious metals, and jewellery industries.

The standards represented a consensus derived from the broad expertise on the subject within the commissions, and also from individuals outside the commissions who had expressed an interest in participating in the development of the guidelines.

The application of the Blue Books' standards is voluntary. However, it is recommended that these standards should apply to all persons, partnerships, and corporations at all stages of the jewellery chain of distribution, from the initial sourcing of all industry products up to and including the creation of jewellery and objets d'art, where applicable.

The Blue Books are living documents that are subject to review annually for revision or reaffirmation. Users are advised to determine whether they have the latest edition of the respective Blue Books.

Comments for revision of the Blue Books standards are welcome from any interested party, regardless of membership affiliation with any trade organization or laboratory. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments.

CIBJO GEMSTONE BLUE BOOK

Designed to assist all those involved with gemstones and artificial products, it records the accepted trade practices and nomenclature for the industry throughout the world.

The standard/rules are non-judgmental, and the definitions and clauses are designed to prevent unfair or deceptive trade practices. They are formatted and worded only to ensure that each gemstone and artificial products bought or sold is done with clarity and honesty. The stability of the marketplace depends upon the use of the proper nomenclature and the declaration of all known facts that ensure a fully informed purchase or sale, throughout the distribution pipeline all the way to the final consumer.

The following definitions apply in understanding how to implement CIBJO Blue Books and some of its normative references, e.g., when applicable ISO standards.

- 'shall' indicates a requirement.
- 'should' indicates a recommendation.
- 'may' is used to indicate that something is permitted.
- 'can' is used to indicate that something is possible.

The Scope (1) of the guide is set out, as are the Normative References. The Terms and Definitions (5) are expansive and are extensively cross referenced throughout the Classifications of Materials (3), Normative Clauses (4), Annex and Tables (8). It is important that the reader refers to the relevant Terms and Definitions when consulting each Normative Clause.

When it comes to the classification of gemstones, the CIBJO Gemstone Blue Book states that two categories of material are recognised: natural materials, and artificial products. Only materials that have been formed completely by nature without human interference/ intervention qualify as 'natural' within this standard.

Gemstones encompass:

- Minerals, e.g., aquamarine, diamond, emerald, garnet, opal, sapphire.
- Natural glasses, e.g., obsidian.
- Rocks, e.g., lapis lazuli, opal with matrix and turquoise with azurite and malachite.
- Organic gem materials, e.g., amber and jet
- Biogenic gem materials, e.g., pearl, coral, and tortoise shell.

Treated gemstones encompass all gemstones/materials that have been subjected to a treatment.

Artificial products include a variety of materials that are partially or completely made by man, while artificial products with gemstone components encompass composite stones such as garnet topped doublets, emerald on glass doublets, natural /synthetic sapphire or ruby composites, ruby-glass composites, pressed amber, and emerald on emerald doublets.

Synthetic stones encompass those materials that have essentially the same chemical composition, physical properties, and structure as that of their naturally occurring counterparts. The term 'synthetic', 'laboratory-created' and 'laboratory-grown' are synonymous.

A synthetic stone shall be described by the correct name of its naturally occurring counterpart immediately preceded by the word 'synthetic', 'laboratory-grown' or 'laboratory-created' which shall appear, in the event of a written presentation, with equal emphasis and prominence, with characters of the same size and colour as those of the name itself. They cannot be abbreviated or have an asterisk next to the name of a gemstone, referring to a footnote explanation of the fact that the product is synthetic.

In the event that the national jewellery association, which is a member of CIBJO, deems that there is no acceptable local direct translation of the English terms 'laboratory-grown' or 'laboratory-created,' then only the translation of the term 'synthetic' should be used.

The word 'laboratory' refers to the facility which produces the synthetic stones. This should not be confused with a gemmological laboratory that is dedicated to the analysis, authentication, identification, of gemstones.

The name of an artificially crystallised product with no known natural counterpart must be used in conjunction with the term 'artificial product' or 'artificial stone' and appear, in the event of a written presentation, with the same requirements expected of synthetic stones.

The name of an artificial stone shall not show a similarity to the name, or sound of the name (neither entirely, nor abbreviated, nor by way of an allusion), of any natural material nor be an established name for another artificial stone.

Correct examples:

Artificial yttrium aluminate - YAG - artificial product or YAG - artificial stone.

Artificial lithium niobate - Linobate - artificial product or Linobate - artificial stone.

Incorrect examples:

Diamantine, Diamlite, Diamonair, Smaryll, Emeraldolite.

Artificial uncrystallised products include man made glass, lead glass, plastic and products of various

compositions, such as pressed materials (e.g., pressed turquoise) that are used to imitate the appearance of gemstones and organic gem materials.

All materials classified above must be named, described, and displayed in accordance with the definitions, annexes and the terminology set by CIBJO. This applies to all publications, advertisements, communications addressed to consumers and to the general or specific information given to a purchaser, prior to or during a final sale, as well as to all commercial documents (e.g., offers, labels, memos, delivery notes and invoices) and to appraisals, identification reports, certificates, etc.

Full disclosure by the vendor to the purchaser of all material information shall take place whether or not the information is specifically requested and regardless of the effect on the value of the product being presented or sold.

In the case of a full verbal disclosure, it must be done using clear and understandable language prior to the completion of a sale.

Full written disclosure shall be conspicuously included on all commercial documents in clear and plain language so as to be readily understandable to the purchaser. The disclosure shall immediately precede the description of the materials and shall be equally conspicuous to that description.

It is contrary to the purposes of this document to make any misleading or deceptive statement, representation or illustration relating to origin, formation, production, condition, or quality that does not conform in all respects with any and all the clauses contained herein.

The terms 'natural treated gemstone' or 'treated natural gemstone' shall not be used because they can be misleading.

Example: 'natural treated ruby' or 'treated natural amber'.

In cases where gemstones are displayed, or jewellery is decorated, with treated gemstones or treated organic substances that require specific information and or with composite stones, synthetic stones, artificial stones and imitations, an easily noticeable and legible label adjoining each item must clearly indicate the precise nature of the objects being shown in accordance with the clauses herein.

The adjectives 'real', 'precious', 'genuine' or 'natural' shall only be used to refer to or designate natural materials.

It is unnecessary to note the genesis of a natural material, as the use of the correct name of the material alone and without qualification states that it is natural.

Names of geographical areas shall only be used when they denote the areas where gemstones have been mined or harvested (place of origin).

When places of origin for gemstones are presented, they shall be considered as a matter of opinion and should not imply a level of quality.

Names of cutting, processing or exporting centres shall not be used to imply geographical origin.

TREATED GEMSTONES

This describes a practice that artificially changes the appearance and/or the durability of a gemstone or gem material by applying heating, diffusion, irradiation, filling, coating, or other artificial processes.

There are three categories of gemstones that have their appearance and or durability altered by a treatment:

Gemstones treated by methods requiring general information

These include substances present in fissures such as oil, wax, resin, polymer, or any similar substances, other than glass, that do not change the colour. Surface waxing where the gemstones have been altered superficially with a colourless agent such as oil, wax, organic fluid, or polymer. Gemstones that have been permanently treated by heating or bleaching.

Gemstones treated by methods requiring specific information

These include gemstones that have been colour treated by artificial irradiation to change their colour, colour treated by, and/or an optical phenomenon created by, diffusion of chemical elements, with the exception of hydrogen and oxygen, from an external source, colour altered by dyes or other colouring agents or stones darkened by the 'sugar/acid' process, treated by the filling of open fractures and or cavities, coated and impregnated with plastic or similar substances.

As an alternative, the word 'treated' may be replaced by terms such as 'Artificially irradiated', 'Diffusion treated', 'Dyed', 'Fracture filled' or 'Glass filled', 'Impregnated', or 'Coated'.

With regard to irradiated gemstones, it is the responsibility of the seller to disclose this information in accordance with national regulations.

Gemstones that are suspected, without certainty, of being treated.

In this case, CIBJO recommends that sellers disclose that the gemstone has undergone a possible treatment. Examples would include heat treated aquamarine, tanzanite and tourmaline or irradiated beryl, kunzite and, tourmaline.

Names of geographic areas

Names of geographical areas producing gemstones and names of cutting or exporting centres shall not be used when referring to artificial products.

Adjectives such as 'real', 'precious', 'genuine', 'natural', 'cultured' or any word or phrase of a similar meaning including 'precious stone', 'gemstone' or 'ornamental stone' cannot be used when describing artificial products.

Sellers must not use the name of any natural material in direct conjunction with the name of an artificial product (for description of colour or otherwise) so that the identity of the stone is not apparent. For example, 'emerald glass' is deemed incorrect while 'aquamarine coloured synthetic spinel' is acceptable.

Artificial products that are partially made by man shall be described by the word's 'doublet' or 'triplet' or 'composite', and these words shall be immediately preceded or followed by the correct names of the components of the assembled product. However, if all parts of a composite (excluding the bonding agent) are the same material, the name of this material shall be stated only once. The words 'doublet' or 'triplet' or 'composite' shall appear, in the event of a written presentation, in accordance with those used for synthetics and artificially crystallised products.

For example, a doublet whose upper portion is a garnet and whose lower portion is glass shall be called a 'garnet/glass doublet' or 'doublet garnet/glass'.

An artificially produced composite stone composed of two parts of colourless synthetic spinel bonded together (by a coloured layer or otherwise) shall be called a 'synthetic spinel doublet' or 'doublet synthetic spinel'.

A composition of two pieces where a slice of natural opal is bonded to a base material shall be called an 'opal doublet' or 'doublet opal'. A composition of three pieces where a thin slice of natural opal is bonded to a dark base and provided with a transparent top layer, usually domed, and usually consisting of quartz or glass, shall be called an 'opal triplet' or 'triplet opal'.

In the case of 'Opal Mosaics', the word 'composite' shall be replaced by the word 'mosaic', when the various parts of the composite are placed side by side (to create a picture or pattern or otherwise) providing that the application of this term adheres to the requirements regarding the term 'composite'.

Brand or manufacturers names

When using a brand name or the manufacturer's name these shall be added to the name of the stone in one of the following manners:

Examples: 'synthetic emerald by (name)' or '(name) synthetic emerald'.

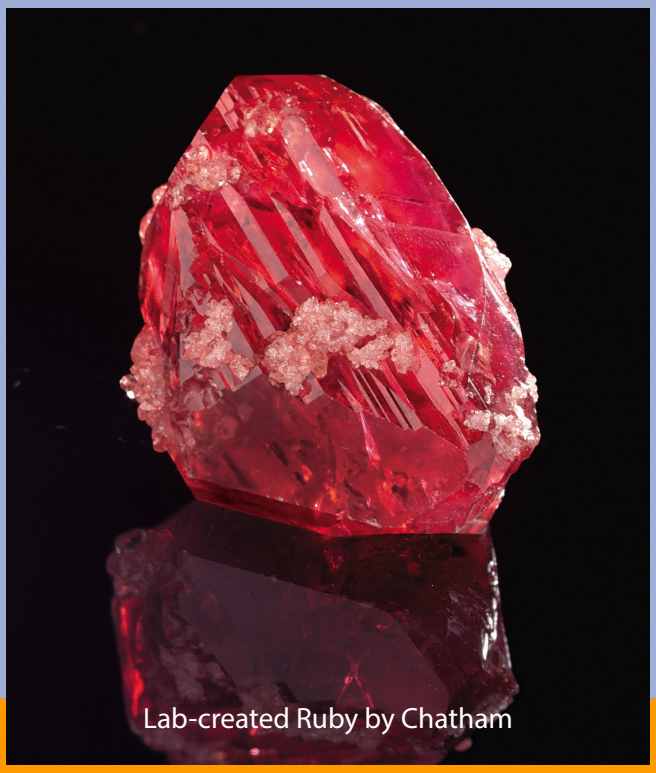
Artificial uncrystallised products

An artificial uncrystallised product shall be described by the correct name of the material of which it is composed, in accordance with the clauses and annexes herein, or it shall be described by the name of the natural material it imitates, immediately preceded by the word 'imitation'. Correct examples would include 'glass', 'plastic', 'ceramic', or 'imitation emerald' or 'imitation coral'.

Cultured

The term 'cultured' is only applied to cultured pearls and no other material.

REFERENCE: CIBJO



Lab-created Ruby by Chatham

QUIZ #25

How much do you know about lab-created gemstones, treatments and enhancements?

15 QUESTIONS.....NO TIME LIMIT!

All entrants who score 100% on the first attempt will be entered into a draw to win our Basic Gemmology course valued at $ 225 USD.

Deadline: January 15th, 2023

START QUIZ

Article Submissions

- We do not accept highly scientific articles.
- All articles should be a minimum of one page.
- All accompanying photographs must be high resolution and must be accompanied by written permission to use the images unless the author owns the rights.
- We reserve the right to refuse articles

E-mail all submissions to:

information@worldgemfoundation.com

New Deadlines Dates for Submissions

March 2023 Issue: December 31st, 2022
June 2023 Issue: March 31st, 2023
September 2023 Issue: June 30th, 2023

Articles for upcoming issues

For the March 2023 issue, we are looking for articles on gem cutting.

For the June 2023 issue, we are looking for articles on jewellery manufacturing and design.

For the September 2023 issue, we are looking for general interest articles.

TREATMENTS

Money honey

Undoubtedly the most fluid and challenging area of gemmology involves the treatment and enhancement of gemstones.

Those involved in the doctoring of gemstones to improve their colour, clarity or overall durability, either permanently or temporarily, see nothing wrong with the modification of gemstones. Some, in fact, welcome developments in this area, arguing that if it were not for Man's ingenuity, certain gemstones might not be commercially available. Tanzanite, the blue-violet variety of the mineral zoisite, owes its colour to heat treatment, turning a relatively unattractive brownish coloured stone into a stunning blue-violet gemstone that can rival at times the finest blue sapphire. Blue topaz owes its colour to a combination of radiation and annealing, while most aquamarines are heat treated to change the valence state of iron from Fe^{3+} to Fe^{2+}. This removes the less desirable yellowish colour component that makes natural untreated aquamarines appear green, and turns the stones blue.

While the treatment and enhancement of gemstones is widespread and for the most part stable and permanent, there are also a number of treatments that are not.

This leads to three important considerations:

1. If a treatment is stable and permanent, does it necessarily need to be disclosed?
2. How do we handle treatments and enhancements that are impermanent and unstable?
3. What impact should these treatments and enhancements have on the overall value of a gemstone?

DISCLOSURE

The goal of every gemstone treater is to profit from his work and the longer the treatment goes undisclosed and undetected, the greater his financial rewards. While many may find this morally and ethically reprehensible, the very fact that the science of gemmology is inextricably intertwined with the buying and selling of gemstones makes it unavoidable.

While the International Jewellery Confederation (CIBJO), The International Coloured Gemstone Association (ICA), and The American Gem Trade Association (AGTA) have all issued guidelines regarding the disclosure of known and detectable treatments and enhancements to their members, those who consciously trade in treated gemstones and hide the fact they have been unenhanced do not belong to these trade organizations. This makes enforcement far more complicated. There is also the challenge of identifying these treatments. This can only be achieved by using highly sophisticated equipment or submitting them to a recognized laboratory. This adds a significant cost that many dealers or jewellers are unprepared to shoulder unless the ensuing laboratory report adds real or perceived value to the gemstone.

But what is the distinction between a gemstone treatment and a gemstone enhancement?

A gemstone treatment refers to any procedure that is performed on a gemstone, while a gemstone enhancement is something, usually a treatment that improves or enhances the gemstone making it more saleable, valuable or durable.

TYPES OF TREATMENTS AND ENHANCEMENTS

So let's take a look at the most common treatments that are currently used in the industry to enhance the appearance and value of gemstones.

Crucible for heat treating with divisions to allow for multiple stones to be treated from different clients / Photo by Geoff Dominy

Furnace for heat treating / Photo by Geoff Dominy

Traditional heat treating method
(Photo by Deborah Craig)

HEAT TREATMENT

The oldest bibliographical reference mentioning the heat treatment of corundum (ruby) is in the book: Al-Jawāhir wa ma Shabhala (Gems and the Likes), about 850-870 AD, written by al-Kindi (Abū Yūsuf Yāqūb bin Ishāq ibn as-Sab-bah ibn Ōmran ibn Ismāil al-Kindi, a great Hellenizing Arab philosopher and scientist (801 - 873 AD)

In his book, al-Kindi describes in a detailed manner the heat treatment applied to rubies:

Irāqi traders possessing the dark kind, desire that it should fetch a higher price. They heat it in a crucible of the Sogdian bole and the roasting process results in it becoming lighter. All the orifices between the two crucibles are thoroughly plugged and the stones are heated in the crucibles, which are specifically designed for heating gems. This process of heating is continued for a period sufficient to melt a mithqāl of gold (a.n.: 1064°C). A poultice is applied to the stones for cooling them. The stone finally crystallizes as a clear and transparent gem and fetches a higher price. This practice is applied when the stone is rendered free from all kinds of concavities and orifices. A poultice of the bole from the mine from where the stone is obtained is then applied. This bole is admixed with ground clay kneaded with clarified butter and dried. It is then heated on firewood, the jewellers being fully aware of the length of time for the heating process. In the event, heating is carried on for an hour at the minimum and twenty-four hours at the maximum followed by cooling. The stone is roasted again in case it does not clarify. As for the mine from where the ruby is brought, it is said that it is situated in the recess of the island of Serāndīb at a place known as Naghz. It is mined from the mountains of that island as well. In the Indian language Serāndīb is Sanklādīp. Dīp is the generic name for an island. When I pounder upon the name it appears to me that the name designates a cluster of islands, that is, a mother of islands surrounded by several isles. [In Al-Bīrūnī's book, kitāb al-jamāhir fi ma'rifat al-jawāhir, Said H.M., 1989.]

Al-Kindi was certainly the scientist who most studied gemstones at that time. He wrote several books on the subject, often very detailed and precise. Among others, one can also mention Kitab khawas al-jawāhir (The Book on the Properties of Precious Gems), about 840-860 AD.

This shows that heat treatment for aesthetic purposes—simple or associating chemical compounds, applied to gems (in the broad sense)—is several millennia old. To the best of knowledge, it was first applied to ornamental 'gems' (considered as precious at that time) and later to what we today call 'precious' gems, the most emblematic being rubies and sapphires.[1]

For those who have witnessed the heat treatment of gemstones firsthand, it is hard to believe that they have any scientific basis. Employing rather primitive and crude techniques, results are often obtained more by trial and error than by scientific prowess.

Trade Names and Misnomers

Gemmology, like most scientific disciplines, uses a system of terms (nomenclature) that are based on principles, rules and recommendations that have been endorsed and accepted by the various international trade and governmental bodies. It also uses trade names and misnomers whose roots can be traced back centuries, often established long before the true nature of a gemstone was known. Red, green, and blue gemstones were commonly referred to as 'ruby', 'emerald' and 'sapphire' simply because our ancestors lacked the scientific knowledge that is available to us today.

While most of today's marketers are not psychologists, the successful ones regularly employ psychology to appeal to their clients. For the most part these are legal, and ethical, designed simply to engage their customers and compel them to buy. Often, they focus on our emotions, use reverse psychology, reposition their competition, promote exclusivity or introduce fear, uncertainty, and doubt.

Often however gem dealers, jewellers and marketers use trade names and misnomers to intentionally deceive the buying public and 'add value' to the gemstones they are selling. Terms such as smoky topaz (smoky quartz), red emerald (bixbite), blue emerald (aquamarine), yellow emerald (yellow beryl), Paraíba-like tourmaline (blue-green tourmaline), and green amethyst (green quartz) clearly play on the use of recognized terminology to stimulate our senses. While they obviously contravene fair trade practices and should be prohibited from being used, the manipulation of the English language is unlikely to change in the foreseeable future as marketers strive to find new and often creative ways to enhance their products.

Ruby

The primary objective of heat treating ruby is to remove the bluish component caused by the presence of ferrous oxide (Fe^{2+}) that gives the stones a purplish colouration. This requires temperatures in the 700 to 1200 degree Celsius range in an oxidizing environment that changes the ferrous oxide to ferric oxide (Fe^{3+})*(Hughes)*. Rubies are also routinely heat treated to improve their overall clarity through the partial or complete dissolution of the rutile needles (silk). This generally involves temperatures in the 1200 to 1800 degree Celsius range. To avoid re-crystallization of the silk, the stones must be allowed to cool slowly.

Blue Sapphire

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

Heating stones progressively through 1200 to 1800 degrees Celsius can intensify the colour of blue sapphires that contain rutile needles. This causes either a complete or partial dissolution of the rutile (titanium oxide) and slowly diffuses the titanium into the stone.

Interestingly, research conducted on natural blue sapphires (Häger, 1992, 1993, 2001; Emmett and Douthit, 1993) shows that there is little or no correlation between the concentrations of iron and titanium and the saturation of blue colouration. This proves that the interaction of the impurities is often just as important as the presence of the impurities.

Golden Yellow Sapphire

Golden yellow sapphires are produced by heating pale yellow or near colourless sapphires at temperatures in the region of 1000 to 1450 degrees Celsius in an oxidized (oxygen-rich) environment. This causes the ferrous iron oxide (Fe^{2+}) to convert to ferric iron oxide (Fe^{3+}).

Aquamarine

Untreated natural aquamarine is normally found with a greenish colouration, often referred to as 'Sea Foam'. This is due to the presence of Fe^{3+}, which imparts a yellowish colour that combines with the blue to give us green. By subjecting the stones to 400 degrees Celsius in a reducing (oxygen-free) environment using an electrical furnace, it is possible to convert the ferric iron oxide (Fe^{3+}) to ferrous iron oxide (Fe^{2+}) thereby removing the yellow component and producing a more desirable and saleable stone.

Pink Beryl

Pink beryl also contains ferric iron oxide (Fe^{3+}) which gives the stones an orangey to apricot colour due to the yellowish colour component. Like aquamarine this can be removed by heating the stones to 350 degrees Celsius in a reducing (oxygen-free) environment using an electrical furnace which converts the ferric iron oxide (Fe^{3+}) to ferrous iron oxide (Fe^{2+}) and turns the stones pink.

Paraíba Tourmaline

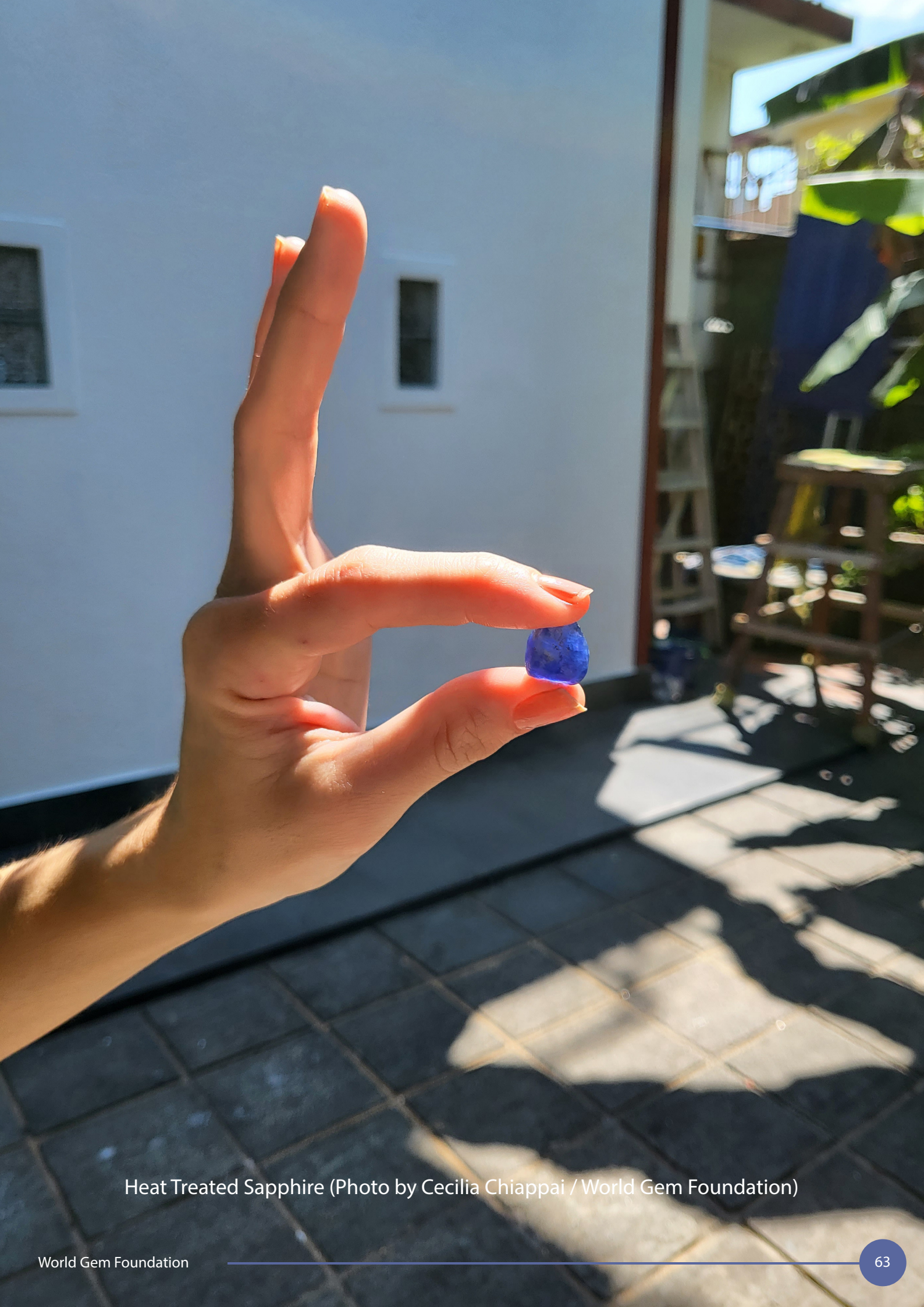
Research carried out by the Gem Testing Laboratory of the Gem and Jewelry Institute of Thailand (GIT-GTL) on copper bearing tourmalines showed that if the test stones were heated using an electric furnace in both a reducing (oxygen-free) and oxidized (oxygen-rich) environment using no additives the stones turned a bright green or greenish blue resembling the typical colour associated with 'Paraíba-type' tourmalines. This involved heating the stones in two hour periods through a series of progressively higher temperatures of 150, 400, 600, and 800 degrees Celsius. While only slight changes were observed below 600 degrees Celsius, the more intense colours were attained in the 600 + degree Celsius range. Since copper is unaffected by heat in this temperature range, the colour change can be attributed to changes in the manganese, titanium, and iron chromophores.

Dark Green Tourmaline

Very dark green tourmalines from the Yunnan Province of China can be transformed into an attractive emerald green by heating them in an oxidizing (oxygen-rich) environment for between three to five hours at temperatures ranging from 550 to 700 degrees Celsius. Dark green Namibian tourmalines will lighten significantly when heated to 370 degrees Celsius.

Zircon

Reddish brown zircons are routinely subjected to heat in the 900 to 1000 degree Celsius temperature range in a reducing (oxygen-free) environment. This produces a variety of colours including blue and colourless. Since the results are rather unpredictable, many of the less desirable colours produced by this method are re-heated in an oxidizing (oxygen-rich) environment at 900 degrees Celsius which turns them red, colourless or yellow. Like amethyst quartz and pink topaz, these colour changes are a result of misplaced electrons that return to their original positions when the stones are subjected to heat.



Heat Treated Sapphire (Photo by Cecilia Chiappai / World Gem Foundation)

Pink Topaz

Pink topaz is typically found with a yellowish brown component that is caused by a displaced electron (similar to amethyst quartz) through exposure to natural radiation. By subjecting the stones to 450 degrees Celsius in a reducing (oxygen-free) environment, the displaced electron is freed and returns to its original position. Initially this turns the stones colourless but upon cooling they take on a pinkish colouration which is often referred to in the industry as 'pinking'.

Blue Topaz

The treatment of blue topaz involves a two-step process. Initially white or colourless topaz is subjected to various forms of radiation depending on what shade of blue is desired. For light blue stones, gamma rays from a cobalt-60 source are used. For a medium blue colouration, high-speed electrons from a linear accelerator are required and for the darker London blue, stones are subjected to high-energy neutrons from a nuclear reactor. During this time significant changes occur in the brown and blue colour centres giving the stones a yellowish-brown colouration. This is subsequently removed by annealing the stones at temperatures ranging between 200 and 250 degrees Celsius for two hours.

Citrine Quartz

Most of the citrine quartz sold today is produced by heat-treating amethyst quartz to temperatures of around 485 degrees Celsius; hence, the term 'burnt amethyst'. In amethyst, the purple colouration is caused by a hole colour centre due to the displacement of one of the electrons. When the stone is subjected to heat, the displaced electron is freed from its trap and returns to its original position giving the stone a yellowish colouration.

Tanzanite

Tanzanite is the blue-violet vanadium-bearing variety of zoisite. In its natural state, stones are greenish-brown to brown. Noted for its strong pleochroism, un-treated tanzanite is trichroic (purple, blue and yellowish-brown), however when it is subjected to heat, two notable changes occur. Firstly the colour becomes more saturated at 410 degrees Celsius and secondly at 500 degrees Celsius the brown colour component disappears.

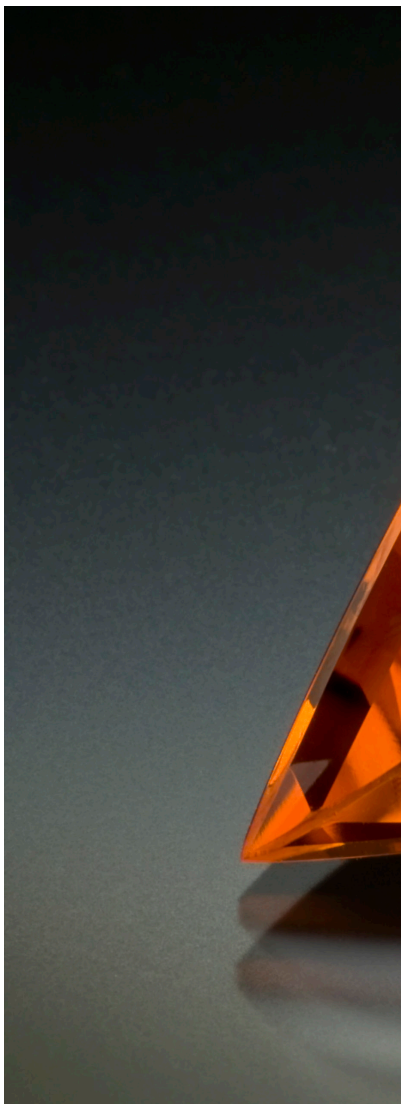
Spectroscopic analysis of heat-treated stones show that during this process the absorption band associated with the brown colour component is removed while the bands commonly assigned to V^{3+} are largely unchanged. Research conducted by Dr. Karl Schmetzer further concluded that the missing absorption band could not be restored after exposing the treated stones to radiation. This supported the theory that the colour transformation did not involve an ordinary colour centre as commonly observed in numerous other minerals (i.e. certain quartz and yellow beryl). Although this change of colour is not completely understood, a combination of absorption spectroscopy and EPR examination shows the presence of both V^{3+} and V^{4+} in un-treated stones whereas only V^{3+} is present after they have been heated. While another trace element may be involved, there does appear to be some connection between the removal of the yellowish-brown colour component and V^{4+}.

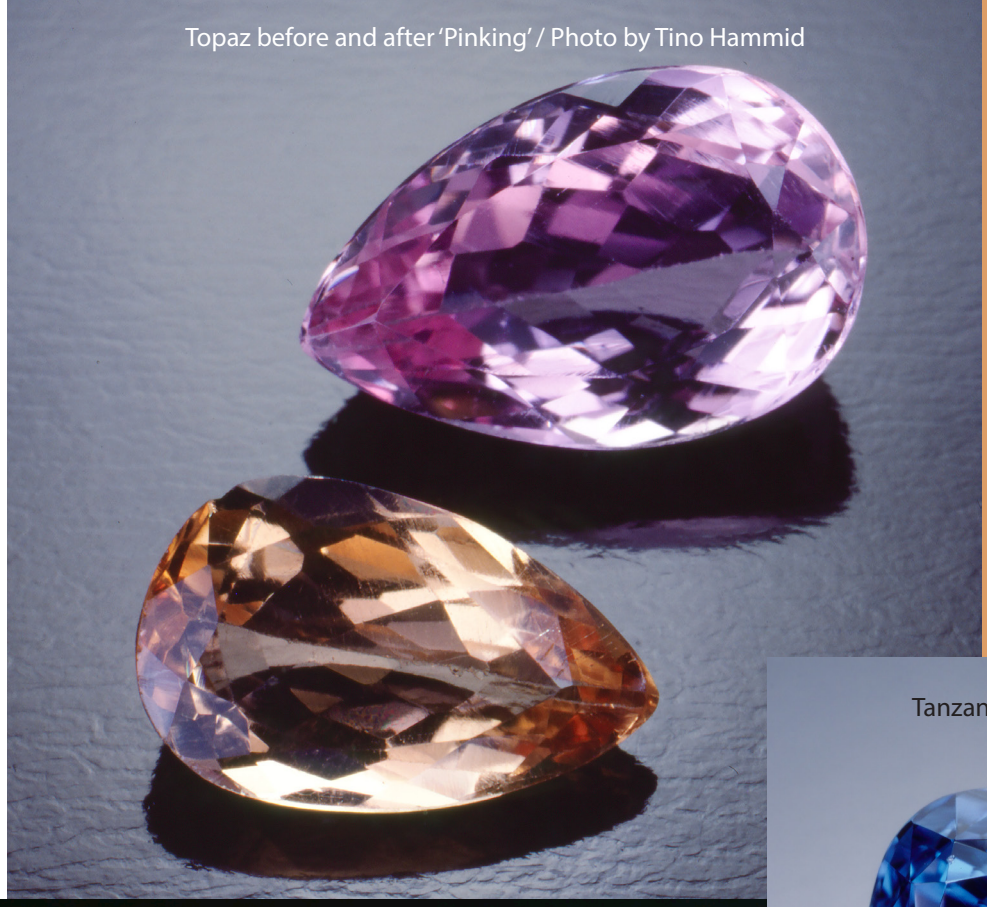
Amber

Amber is often heated to either improve the colour or the clarity. Pale coloured amber heated in an oxidizing (oxygen-rich) environment will turn red to reddish-brown while cloudy amber is often heated in rapeseed oil that has a similar refractive index to amber. This allows the oil to infiltrate the stone, filling fractures and air bubbles, and creating disc-like stress fractures known as sun spangles.

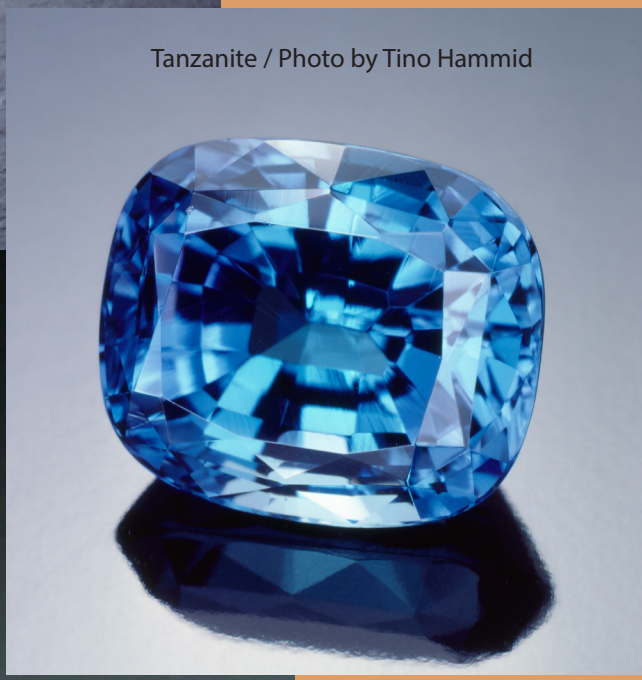
Pre-fashioned pale coloured amber can also be coated by heating it at relatively low temperatures, thought to be in the region of 50 to 200 degrees Celsius for up to five hours. This produces a thin orange-brown skin.

Pressed or reconstructed amber, also known as ambroid, is produced by heating carefully selected small reject pieces of amber or even ground amber at approximately 180 degrees Celsius in a large metal pressurized container.

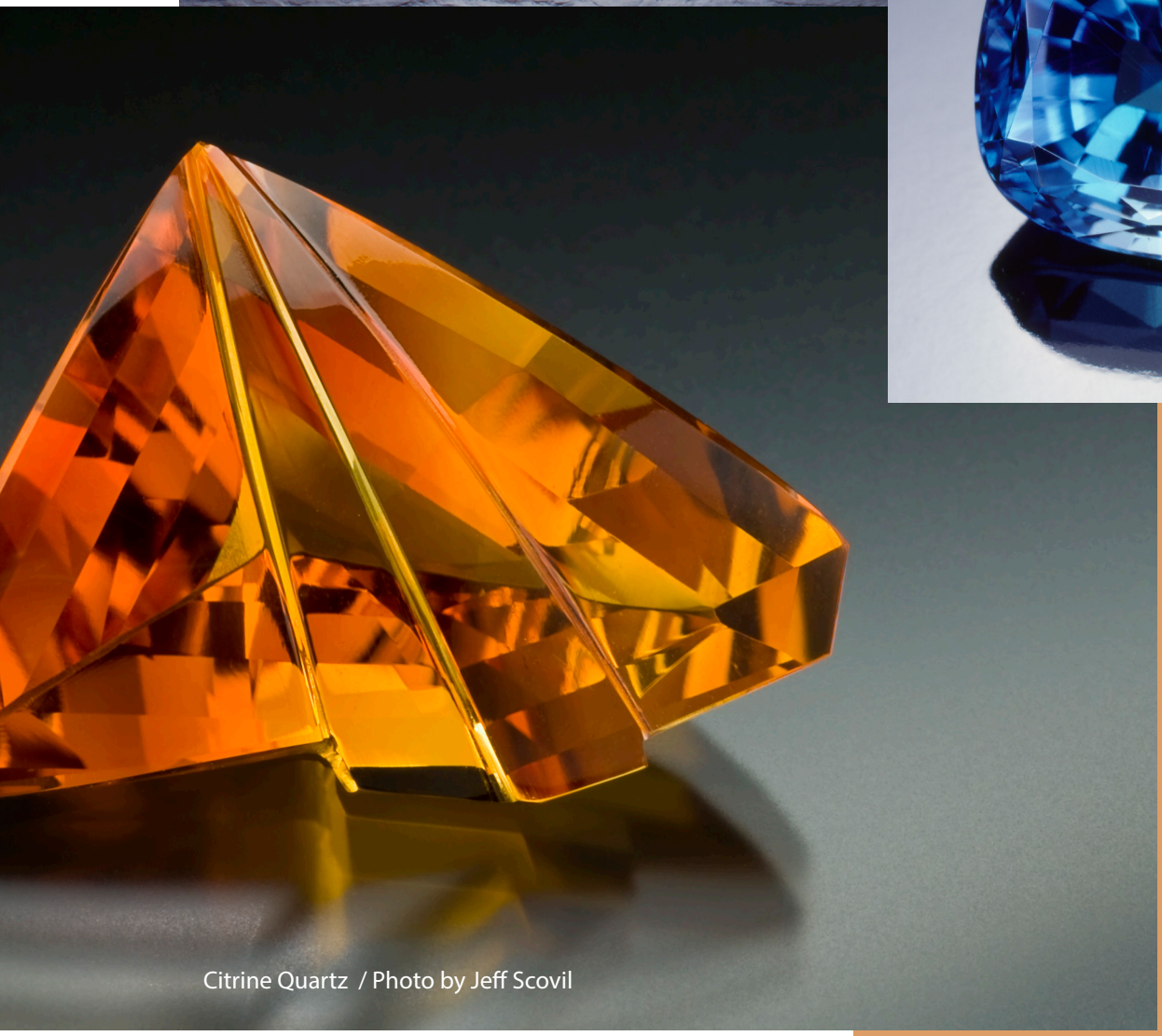




Topaz before and after 'Pinking' / Photo by Tino Hammid



Tanzanite / Photo by Tino Hammid



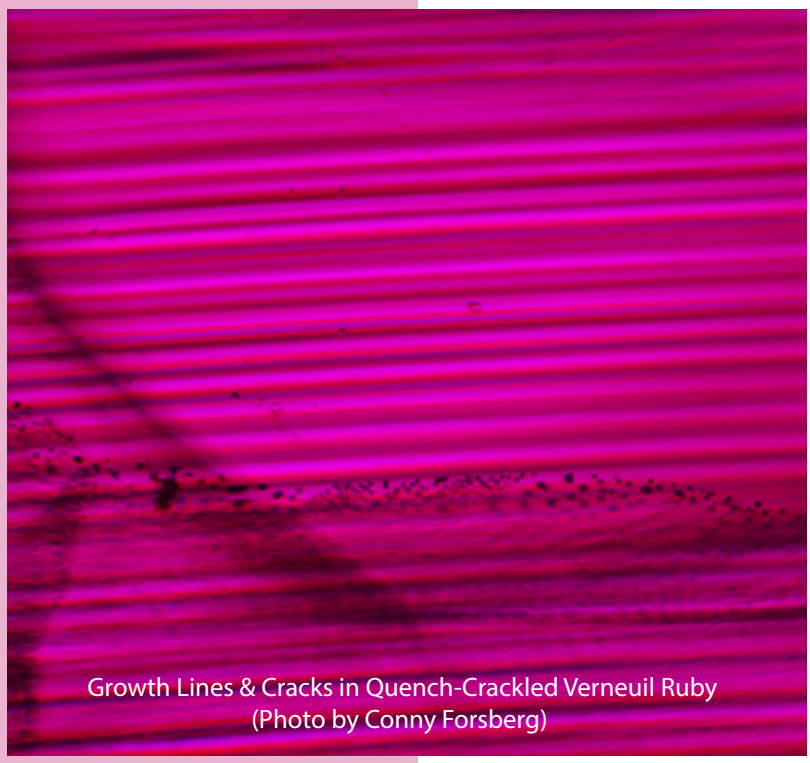
Citrine Quartz / Photo by Jeff Scovil

HIGH HEAT + PRESSURE (HT+P)

The use of high temperature and low pressure to treat blue sapphires can be traced back to the late 1990's. Using low-pressure (~1kbar) autoclaves, the treatment involves tightly packing a blue sapphire (generally one at a time) in graphite powder with a few drops of water and sealing the crucible with a small ceramic ring and a plate of molybdenum. The use of graphite not only creates a reducing atmosphere but also ensures that there is an equal transference of heat. While the process takes substantially less time than traditional heat-treating (around 30 minutes), the results are far less predictable. This is because the 'phase' change is so rapid that it is hard for the treater to control.

QUENCH-CRACKLING

In an attempt to make Verneuil flame fusion gemstones appear more natural looking, many stones are heated to almost melting point and then immersed in water. This causes a rapid contraction of the material and the formation of cracks and fissures. Subsequent re-heating, over a three-day period, encourages the partial healing of the fissures and cracks resulting in stones reminiscent of Burmese rubies and Sri Lankan sapphires.



Growth Lines & Cracks in Quench-Crackled Verneuil Ruby
(Photo by Conny Forsberg)

SURFACE AND SUB-SURFACE DIFFUSION

Early attempts at diffusion, mostly involving blue sapphires, involved the coating and surface diffusion of pale-coloured faceted blue sapphires that had been packed in a clay mixture, containing ferrous oxide and titanium dioxide or powdered 'synthetic' blue sapphire, and heated for several days at temperatures in excess of 1700 degrees Celsius. This imparted a blue rind over the stones, which was subsequently re-polished. Since the rind was less than 0.5mm thick, this often resulted in stones either being polished too much, causing the underlying stone to be visible when immersed in methylene iodide, or areas that were left unpolished.

By the late 1980's however, stones began to appear on the market that had thicker rinds, produced by prolonged exposure to heat, allowing polishers to improve the polish of the finished stones.

These deep diffused stones were more difficult to detect and caused a great deal of consternation to gemmologists and the industry in general. At the same time, United Radiant Applications, among others, started diffusing pale sapphires with chromic oxide producing surface diffused rubies.

In the early part of the 21st century, large numbers of deep coloured orange sapphires started to appear in the market. After exhaustive research and testing that included successful attempts to replicate the process using crushed chrysoberyl (beryllium) and sapphires from Madagascar, the producers of these stones finally admitted that the product was a result of beryllium sub-surface (lattice) diffusion. Like surface diffusion these stones started out with a pale faceted sapphire, but in this case the colour permeated throughout the entire stone making their identification far more difficult.

IRRADIATION

Radiation can be used to change the valence state of a transition metallic element (i.e., ferric iron oxide in pale yellow sapphires to ferrous iron oxide producing a deep orange-yellow colouration), induce a colour centre (irradiated fluorite) or impart a surface colouration (diamonds) by exposure to high-energy neutrons in an atomic reactor, electron bombardment in an electron accelerator, using a cyclotron, ion-implantation or ion injection. Often heat is required to stablize these colour changes.

The list of stones currently treated with radiation covers most of the important gem species including beryl, chrysoberyl, corundum, diamond, quartz, spodumene, topaz, tourmaline, zircon, and pearls.

Blue Topaz

Perhaps the most commonly encountered irradiated gemstone is blue topaz. Although it does occur naturally, most natural blue topaz is very pale in colour and of little or no value.

Available in three shades: light blue, sometimes referred to as sky or Sierra blue, medium blue, often referred to as Swiss blue, and a darker greenish blue known as London blue, it is produced from white topaz, which is irradiated and then annealed. Three different types of radiation are used to produce the different colours, namely, gamma rays from a cobalt-60 source, for light blue, high-speed electrons, from a linear accelerator, for medium blue and high-energy neutrons, from a nuclear reactor for darker London blue stones.

Once irradiated the stones are annealed at between 200 to 250 degrees Celsius for two hours to remove the unwanted yellowish and brownish overtones caused by the brown colour centres formed during the radiation process. This also stabilizes the resultant blue colour.

Yellow Sapphires

Through exposure to gamma rays, it is possible to impart a deep orangey-yellow colour in pale yellow sapphires. This causes the ferric iron oxide (Fe^{3+}) to convert to ferrous iron oxide (Fe^{2+}) (Nassau 1984). This treatment however is unstable and must be disclosed since stones will fade when exposed to strong sunlight or when heat is applied.

Padparadscha Sapphires

Pink sapphire can be transformed into padparadscha sapphire when subjected to radiation. Like irradiated yellow sapphire this causes the ferric iron oxide (Fe^{3+}) to convert to ferrous iron oxide (Fe^{2+}) when chromium is present (Nassau 1984). This treatment is unstable and must be disclosed since stones will fade when exposed to strong sunlight or when heat is applied.

Natural and Lab-Created Quartz

A purplish colouration is produced by subjecting hydrothermally grown quartz or colourless, yellow or pale green natural quartz with trace amounts of Fe3+ (ferric oxide) to gamma rays. The radiation causes the Fe^{3+} to convert to Fe^{4+}.

Maxixe Beryl

Originally discovered in 1917 in the Maxixe mine of the Piaui area south of Arassuahy in Minas Gerais, Brazil, natural Maxixe beryl derives its colour from exposure to natural radiation in the ground, which creates a colour centre. However, this colour is extremely unstable and often fades when exposed to strong sunlight or temperatures over 100 degrees Celsius.

In 1970 a suspicious dark-blue beryl started to appear on the market resembling natural Maxixe beryl. This new material comprised of yellow and green beryl that had been treated with radiation to turn it a dark blue. Like the natural material the colour was also unstable tending to fade when exposed to strong sunlight and heat.

Pink & Red Tourmaline

Enhanced pinks and reds are produced by exposure to gamma rays which converts the Mn^{2+} to Mn^{3+} (*Manning 1973*). After treatment, some stones may still be radioactive and should be handled with care.

Kunzite

Discovered in 1902 and named after George Frederick Kunz, chief jeweller and noted mineralogist at Tiffany & Co at the time, kunzite derives its colour from small trace amounts of manganese, and like amethyst quartz, will fade if exposed to strong sunlight or heat. However, when irradiated the Mn^{4+} converts to Mn^{3+} (*Petrov 1990*) creating an unstable and usually radioactive stone that should be handled and stored with extreme care in a radiation-safe lead container.

Pearls

Pearls are often colour enhanced using gamma radiation and radiation from a particle accelerator.

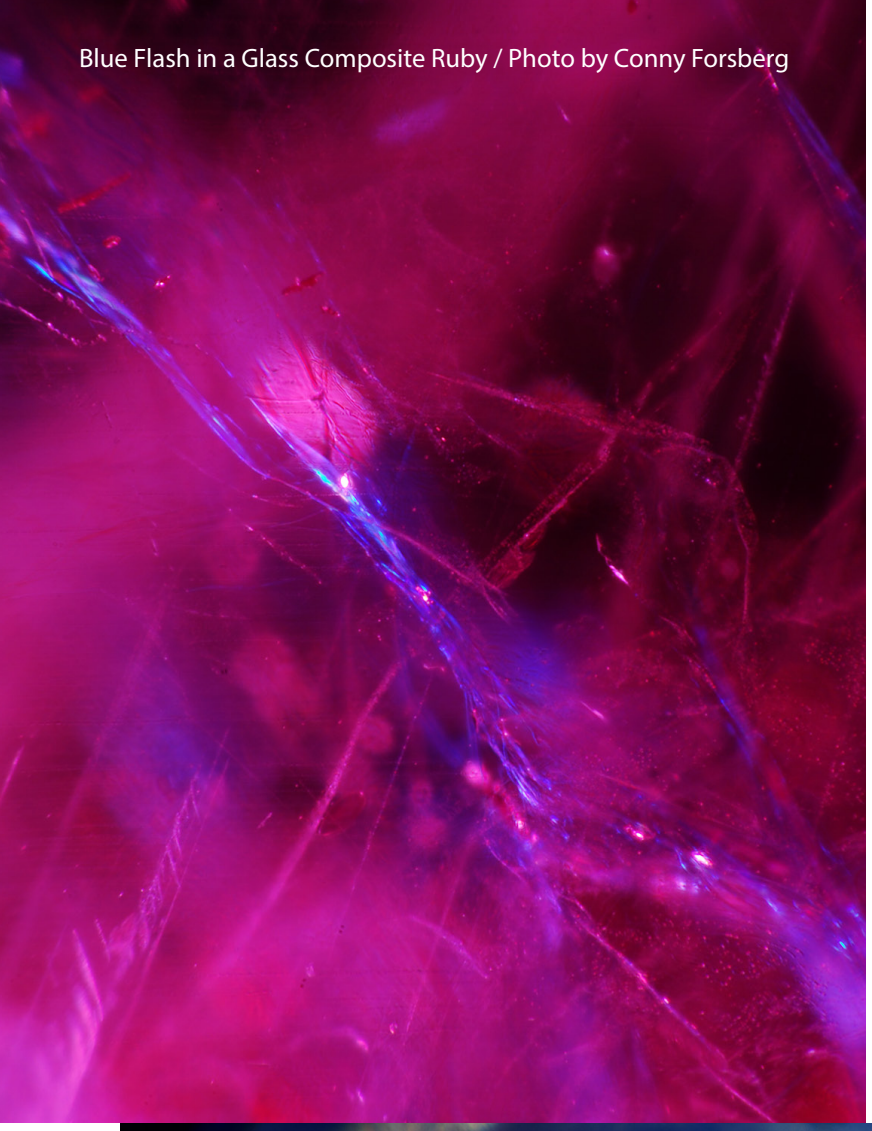
Purple Fluorite

Exposure to gamma rays turns colourless fluorite purple. This is caused by a radiation induced colour centre where one of the fluoride ions is dislodged thereby creating a vacancy.

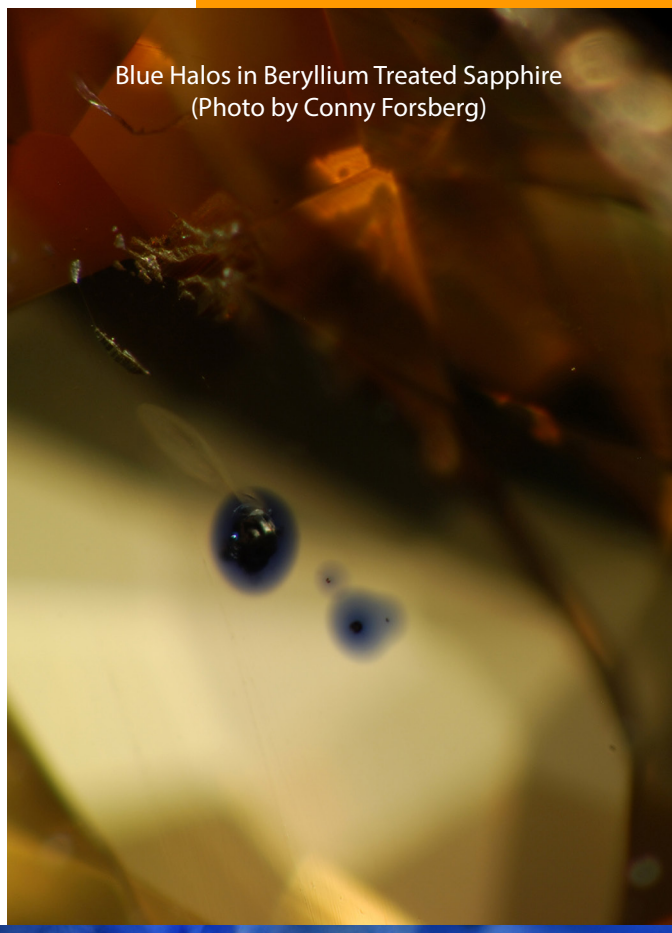
Diamonds

Due to the high cost of naturally coloured diamonds, silver and cape-coloured diamonds (L colour or lower) are routinely irradiated to produce a variety of hues including pink, yellow, green, greenish/blue, cinnamon brown, and purple.

Sir William Crookes, an Englishman, first demonstrated the effects of radiation in the early 1900's by storing a large brilliant cut diamond in powdered radium bromide for 16 months. This not only made the diamond radioactive but also produced a pale green colouration.



Blue Flash in a Glass Composite Ruby / Photo by Conny Forsberg



Blue Halos in Beryllium Treated Sapphire (Photo by Conny Forsberg)

Cobalt Glass in Sapphire (Photo by Conny Forsberg)

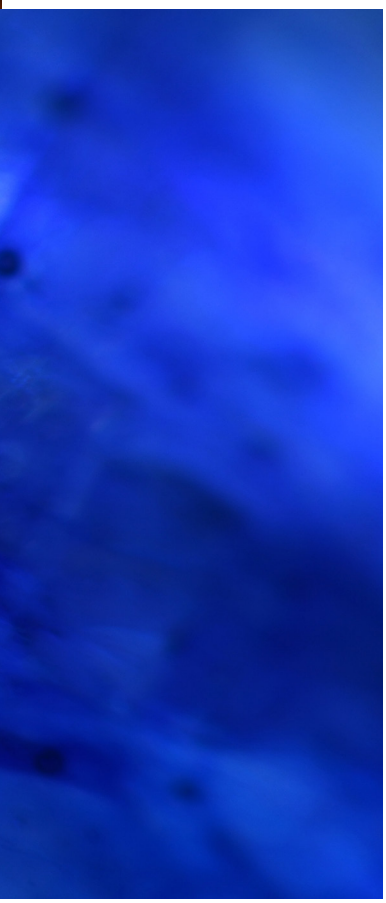
While the colour was only skin deep, there was no reversion or diminution of colour over a twelve-year period proving that the colour was stable.

Colour can also be produced by exposure to high-energy neutrons in an atomic reactor, resulting in a green colour, which permeates the stone and is subsequently changed to yellow or golden yellow/ brown by heating the stones at 800 degrees Celsius.

Electron bombardment in an electron accelerator produces a skin-deep pale blue to bluish green colour and a skin-deep colouration of varying hues can be produced using a cyclotron.

More recently, diamonds have been colour enhanced using ion-implantation. InColor Enhanced Diamonds™ of Ohio currently produce green and black diamonds using an electron linear accelerator, in this case a 1-2 MeV model that is capable of accelerating electrons to high energies by means of guided electromagnetic waves. According to the producers, treatment times range from a couple of minutes for green diamonds to several hours for black diamonds with no residual radiation detected after the procedure.

Invented and patented by Park Jaewon, Lee Jaehyung, Sohn Changwon and Choi Byungho (Japan Patent 2005-247686), ion injection involves the production of colour by accelerating ions under vacuum and injecting them into the surface of a diamond, followed by heat treatment to stabilize the colour. These ions can induce optical bandgap change with a wide variety of colours possible. According to the patent holders, this new technique substantially lowers the cost of production compared to conventional ion-implantation methods using metal ions.



LEAD-GLASS FRACTURE FILLED

Fracture filling, particularly using high lead content glass, poses a serious problem both to gemmologists and the trade in general.

The first glass filled rubies and sapphires originating from Morogoro, Tanzania and to a lesser extent from the Mogok region of Myanmar (Burma) started to appear in the early

Oil in treated Ruby
(Photo by Conny Forsberg)

1980's. In some cases, rubies and sapphires were found containing more than a 50% lead glass content. This not only increased the weight of the finished stone but also made them very unstable when subjected to heat or cleaned ultrasonically.

FLUX ASSISTED PARTIAL FISSURE HEALING (FAPFH)

As early as 1992, unusual rubies started to appear in Bangkok from the Möng Hsu region of Myanmar (Burma) that appeared to not only be heat-treated but also flux healed. Subsequent research revealed that prior to being treated these stones contained dense clouds of exsolved matter, believed to be hydrous alumina (diaspore), had a strong purplish-blue colour that was caused by their unusual blue crystal cores and contained numerous cracks and fissures that made them not only difficult to cut but for the most part un-saleable. The application of heat and a high-temperature solvent (flux) such as borax together with other chemical constituents not only diminished the clouds and removed the bluish component but healed the cracks and fissures as well (*Hughes*).

In 2009, new rubies from Niassa Province and the town of Montepuez in the Cabo Delgado Province of Mozambique began to appear. While the Niassa rubies showed evidence of being lead glass-filled, the rubies from Montepuez appeared to be treated using the same 'flux-assisted partial-fissure-healing' (FAPFH) technique used to treat Möng Hsu rubies (*Pardieu et all May 2010*) however, there was one important difference. Unlike the original Möng Hsu rubies, these rubies also contained surface reaching unhealed fissures that had been glass-filled. The industry was now faced with yet another variation on an all too common theme, this time using a combination of treatments. Interestingly however, when the glass filling in the Montepuez rubies was analyzed they did not show significant amounts of lead or bismuth compared to the glass-filled rubies from Niassa.

To understand this better it is important to explain the differences between flux-assisted partial-fissure-healing (FAPFH) and regular glass filling.

In FAPFH stones, the technique is not dissimilar to the welding of two pieces of metal using a flux to lower the melting point. As the stone is heated to around 1850 degrees Celsius, the flux enters the stone through the cracks and crevices dissolving the walls of the fissures. As the stone cools, the cracks are sealed with what is essentially 'synthetic' ruby formed through the re-crystallization of the molten material. Since this is not performed in a vacuum, small pockets of trapped gas and solidified flux glass become trapped in the fissures with residual flux glass found on the surface. This is removed by using acids (*Hughes - Foreign Affairs: Fracture healing/filling of Möng Hsu ruby*).

In regular glass filled stones, the fractures and features are not welded together, simply filled with a glass filling. The most significant difference between the two is their overall stability with FAPFH treated stones considered stable while the glass filled stones are not.

A modified version of this technique involving the use of both borax and silica was pioneered by famed Thai treater Thawatchai Somjainuek who took the unprecedented step of disclosing his technique to the Gemmological Institute of America (GIA) in Bangkok in an effort to not only create greater transparency but also to ensure that the stones were properly disclosed. His technique was aimed at improving the appearance of lower grade rubies and making them more saleable.

This involved soaking the stones in diluted hydrofluoric acid (1:1 ratio with water) for three days and then heating them, along with the borax and silica, at 1400 degrees Celsius for 20 hours in an oxygen rich environment (*Pardieu et all May 2010*).

GLASS FRACTURE-FILLED

In the early part of this century, Thai gem treaters had perfected yet another method, which appeared to be a modified version of the Yehuda fracture filling technique (used to clarity enhance diamonds), on heavily fissured rubies from Andilamena in Madagascar (*Pardieu et all May 2010*).

This in essence created three types of fracture filled stones: FAPFH where the unhealed fissures were healed using fluxes and other chemical constituents, LGFF (lead glass fracture-filled) and GFF (glass fracture-filled).

Again the issues of proper classification and disclosure became a hotly debated topic. While some argued that since the FAPFH treatment was irreversible and increased the stability of the stone it was not necessary to disclose it; others argued that unlike natural emeralds, where cracks and fissures are commonly found, and allowances are made from a clarity grading perspective, the same is not true of rubies where cleaner stones are available. This issue was addressed in part by the Laboratory Manual Harmonization Committee (LMHC) through the issuance of residue quantification terminology for flux healed rubies (see insert below).

WHAT IS THE LABORATORY MANUAL HARMONIZATION COMMITTEE (LMHC)

Gemmological laboratories offer a wide range of services from gemstone and gemstone treatment identification to origin determinations and diamond grading. Their services include the identification of the nature of a particular gemstone, whether it is an unaltered gem formed in nature, a synthetic created by man or even an imitation. Gemmological laboratories

The Laboratory Manual Harmonisation Committee (LMHC) is comprised of representatives from the following gemmological laboratories located in Europe, USA and Asia (listed here in alphabetical order):

- *the CGL Laboratory, located in Tokyo, Nagoya, Osaka, Fukuoka & Kofu in Japan.*
- *the CISGEM Laboratory, located in Milan, Italy.*
- *the DSEF German Gem Lab, located in Idar Oberstein, Germany.*
- *the GIA Laboratory with 5 locations: Two in the USA (Carlsbad and New York); one in Bangkok, Thailand; one in Tokyo, Japan; one in Hong Kong.*
- *the GIT-Gem Testing Laboratory, located in Bangkok, Thailand.*
- *the Gübelin Gem Lab Ltd., located in Lucerne, Switzerland.*
- *the Swiss Gemmological Institute - SSEF, located in Basel, Switzerland.*

can also determine if a gem is treated to improve its colour or transparency and some can also provide information about the probable geographic origin of a gemstone.

Previously laboratories located in different continents and markets were using their own report wording and language to describe the results of their testing. Along with the globalisation of the industry and ease of consumer travel, there became a need for greater harmony in the wording used in gemmological laboratory reports.

While the LMHC was originally formed at the request of GILC, the LMHC is not formally connected to any trade organization.

The LMHC draws on the individual experiences of its members for the purpose of creating a general philosophy for proper nomenclature and disclosure for laboratories as well as to initiate and suggest 'preferable' language to be used in the trade.

The goal of the Laboratory Manual Harmonisation Committee is to achieve the harmonisation of gemmological report language and thereafter the revision of this harmonised report language as used by LMHC members.

The LMHC regularly meets to update or add to the contents of a manual. When they are relevant to the trade, parts of this manual are released in the form of Information Sheets.

The opinions or findings in these documents are based on the state of knowledge at the time of the latest publication and may change as new information becomes available.

COBALT-DOPED GLASS-FILLED SAPPHIRES

Appearing in 2007 and credited to Tanusorn Lethaisong, a Thai gem treater from Chanthaburi, the original incarnation of these cobalt-doped glass-filled sapphires used highly included low-grade near colourless corundum from either Madagascar or Sri Lanka. Dubbed 'Super Diffusion Tanusorn', the treatment did not actually involve diffusion at all, merely the filling of the open fissures with cobalt-doped glass. This essentially coloured the entire stone, in much the same way carefully oriented colour concentrations do in natural stones.

In 2012, G.I.T (Gems and Jewelry Institute of Thailand) examined sapphires that appeared to have undergone a similar but more refined version of the original treatment exhibiting features typical of glass-filled rubies (*Leelawatanasuk, Atitchat, Pisutha-Arnond, Wattanakul, Ounorn, Manorotkul & Hughes) (GIT – Gems and Jewelry Institute of Thailand) (March 2013*).

Code	Description
NTE	*No Indications of treating*
TE	*Indications of heating but with no residue*
TE1 & TE2	*Indications of heating and minor residue in the fissures*
TE3 & TE4	*Indications of heating and moderate residue in the fissures*
TE5	*Indications of heating and significant residue in the fissures*
C1	*Indications of heating and minor residue in the cavities*
C2	*Indications of heating and moderate residue in the cavities*
C3	*Indications of heating and significant residue in the cavities*

CLARITY ENHANCED DIAMONDS

Glass filling is also used to enhance the appearance of diamonds by making the inclusions less visible. Using a highly refractive glass containing lead, chlorine, oxygen, and bismuth, it is introduced into the surface reaching

cavities using high pressure and temperatures of around 400 degrees Celsius.

One of the pioneers of glass filling was Zvi Yehuda, an Israeli scientist who developed the technique in 1982.

Used primarily to minimize the appearance of 'feathers' in natural diamonds, the process inserts a microscopic amount of filler, with similar optical properties as the host diamond, into the area that contains the feather.

In light theory, when light travels from one medium into another, it undergoes refraction, which causes it to change course. When light attempts to pass through a feather-like inclusion, the light is often reflected back. This makes the feather more apparent and visible. However, when the light strikes the surface of a feather that has been filled with a substance that has a similar refractive index to the diamond, the passage of light is unaffected making the inclusion less visible and the diamond more saleable.

In addition to the Yehuda Diamond Company, other companies have produced diamonds using similar processes including Koss & Schecter, another Israeli-based company, using both halogen and halogen oxide glasses and Dialase Inc. whose technique was similar to Yehuda.

HPHT

The very same apparatus used to synthesize diamonds can also be used to improve the colour of yellowish and brownish coloured diamonds. This is of particular concern since improving the colour grade can substantially increase the value of a diamond.

Permanent diamond treatments involve the re-organizing of the defects in the diamond lattice with diamond type playing a crucial role.

For example, diamonds treated solely by irradiation will produce green to blue colourations regardless of type, however, irradiation followed by heating to between 800 and 1000 degrees Celsius will produce intense yellow, orange, pink or red colours in type I diamonds because of the presence of nitrogen atoms that are needed to create the colour-producing defects. The absence of nitrogen impurities however in type II diamonds makes them unsuitable for this type of treatment.

In the case of HPHT treated diamonds, several results can be obtained dependent on the diamond type including de-colourization (from brown to colourless or near-colourless), a lightening of the colour or even a change of colour.

Type I Diamonds

Brownish diamonds will take on a yellowish colouration. However, if they are subsequently irradiated with low pressure annealing, some type Ia and Ib diamonds will turn an intense pink, red or orange.

The colour of yellowish type Ib diamonds will lighten due to the nitrogen atoms migrating towards each other and forming clusters similar to type Ia diamonds. This migration and consolidation of nitrogen atoms converts some of the type Ib material to type Ia.

Brownish coloured type Ia diamonds will turn a greenish-yellow if subjected to temperatures of 2000 degrees Celsius and pressures of 50 to 60 kilobars.

Type II Diamonds

Two scenarios are possible when treating brownish type II diamonds; type IIa will change to either colourless, near-colourless or even pink while type IIb can turn blue.

SURFACE MODIFICATIONS

Surface modifications can include oiling, using colourless or coloured oils, the use of dyes, resins and polymers, wax impregnations, surface coatings, bleaching, smoke inhalation, sugar and acid treatments, and glass filling.

Under no circumstances should any of these treatments be considered permanent and stable since it is impossible to predict how long they will last. Assertions made by manufacturers of epoxies and resins, such as Excel and Opticon, can claim that their products will not breakdown over a period of time, but in reality, it is difficult to make such claims and assertions unless their products are tracked and the long term durability documented.

When it comes to surface modifications, it is important to remember two things:

Firstly, no one will treat a fine quality stone with dye or a coloured oil. There is no reason to do so and if they do, they risk assumptions being made that the stone is of a lesser quality. These treatments are designed solely to improve the appearance of lesser quality stones and make them more saleable.

Secondly, oils and dyes can only be introduced into materials that have surface reaching fissures and cracks or are porous by nature. It is simply impossible to introduce oil into a stone that does not have any surface reaching cracks or fissures. These fissures and cracks can be artificially induced but why would the owner of a valuable piece of rough or a faceted stone take such a risk?

HPHT treated Diamonds (Photo by Tino Hammid)

Emerald - Natural or Treated? / Photo by Tino Hammid

Oiling

The oiling of gemstones involves the use of either a colourless oil to hide the cracks or fissures or coloured oils, such as Joban that not only hide the imperfections but also enhance the colour.

To do this successfully, specific oils need to be used depending on the material being treated. Just like immersion tests, which match the refractive index of the gemstone with that of the immersion liquid, oils need to have a similar refractive index to the stone being treated so that they minimize the appearance of the cracks and fissures.

Oiling can be performed in two ways. The first method involves simply soaking the stone in an oil of similar refractive index. The second requires cleaning the stone using hydrochloric acid (in the case of emeralds) and then a mild detergent or an ultrasonic cleaner when handling stones of a more robust nature. The stones are then soaked in oil that has been heated to decrease its viscosity and placed in a vacuum. This allows the oil to be introduced into the stone using a capillary action. After oiling, certain stones may be further heated at low temperatures to ensure a degree of stability.

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

Waxes & Dyes

Waxes are often used to stabilize material. Turquoise and lapis lazuli are routinely treated with colourless paraffin wax, bee's wax, aqueous silica, and colourless polymers. These are often used in conjunction with various dyes.

Dyed agates are invariably found in less expensive jewellery. These include Swiss lapis, which is made from dyed jasper and imitation turquoise made from dyed howlite.

Quench-crackled colourless quartz and pale-coloured sapphires can also be dyed and/or polymer-coated and are often sold to unsuspecting tourists as natural rubies, sapphires, and emeralds.

Of particular concern in the industry is the profusion of B, C and B + C jade that has been either chemically treated and resin impregnated to enhance its transparency (B jade), dyed to enhance its colour (C jade) or both (B + C jade). Sold in a variety of colours from various shades of green to mauve/lilac, yellow, and black, these stones have been introduced to combat the increasing difficulty in obtaining gem grade jadeite from Myanmar (Burma) and the substantial price increases that have been imposed over the last 50 years. It is extremely important that this treated jade is detected and disclosed.

Sugar/Acid & Smoke Inhalation

Black opal can be simulated by impregnating the interstices of lower grade Australian Andamookan opals with carbon particles. This enhancement technique was described as early as 1823 in John Maw's book entitled A Treatise on Diamonds and Precious Stones and involved the use of heated oil or grease that was subsequently burned off. Today, similar techniques are still used to create black opal, including the heating, and soaking of stones in a sugar solution, which is later carbonized by using warm sulphuric acid.

Opals can also be smoked, a process that involves wrapping the stones in brown paper and then charring them. This produces a dark brown coating, which intensifies the play of colour. Currently, due to their porous nature, 'Wollo' Ethiopian opals are enhanced using this technique.

Finally, pearls are routinely bleached using warm hydrogen peroxide and dyed to improve or change their colour. This includes the use of pink dyes to impart a pinkish overtone, silver nitrate or aniline dyes to produce black pearls, and a variety of other dyes to produce multi-coloured pearls. Chocolate pearls, marketed by the Ballerina Pearl Company, are black Tahitian pearls, which have been bleached to alter the organic compounds in the black pearls, giving them their chocolate colouration.

Coatings & Foil Backs

Several coatings and foil backs are used to improve the colour or appearance of gemstones. These include diamonds, cubic zirconia and lab-created moissanite coated with CVD lab-created diamond, a light blue coating resembling nail polish applied to the pavilion of a yellowish diamond to superficially improve the colour, pale green beryl coated with a green polymer to imitate more expensive emeralds, acrylic sprays applied to enhance the lustre of more porous stones, and foil and mirror backs often found on gemstones set in antique jewellery in closed back settings.

Faceted gemstones can also be coated with a micro-thin layer of pure gold or metallic oxides. This creates an iridescent effect, which is quite unnatural looking but highly decorative. These enhancements are achieved by using a technique called vacuum sputtering. This involves placing the stones in a vacuum, attaching a positive electrical charge to the stone to create an anode, and then evaporating various metals at the negatively charged cathode so that they are attracted across the vacuum and deposited on the stones.

Mystic topaz and aqua aura quartz are two stones produced using this procedure however it should be noted that damaged or chipped stones cannot be re-polished otherwise the surface coatings will be removed.

Laser Drilled Diamonds

A common practice used to improve the appearance of a diamond is laser drilling. This involves the drilling of fine tubes into dark inclusions, often no more than 0.005 inches in diameter, and the subsequent bleaching of the inclusions using hydrofluoric acid. The holes are then filled to prevent any foreign matter entering them.

In 2000, a new technique of internal laser treatment, known simply as KM (Kiduah Meyuhad meaning special drill in Hebrew), was developed. Unlike the conventional laser drilling, this technique uses a laser that when focused on an inclusion induces an internal fracture that can be quite similar in appearance to a natural feather. In some cases, the fracture will extend to the surface allowing the use of strong acids to bleach the inclusion. However, in some instances, the heat of the laser is sufficient to improve the appearance of the inclusion without leaving any surface reaching fractures.

CONCLUSIONS

Sadly many involved in the gem industry have little or no gemmological knowledge and this is both disconcerting and dangerous.

If you do not know what you are buying or selling, how can you protect yourself and your customers?

The goal of this article is two-fold; to explain the various treatments and enhancements used in the industry and to create awareness. Knowing that something exists is just as important as knowing how to detect it. Remember this is an industry built on trust. If you lose that trust, it is very hard to win back. Knowledge is a powerful tool that fosters professionalism and allows you to ask the 'tough' questions. It will also deter those who seek to profit from selling treated stones without full disclosure because the last thing they want is a knowledgeable buyer.

Education is your best friend, embrace it.

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World Gem Foundation - Advanced Gemmology

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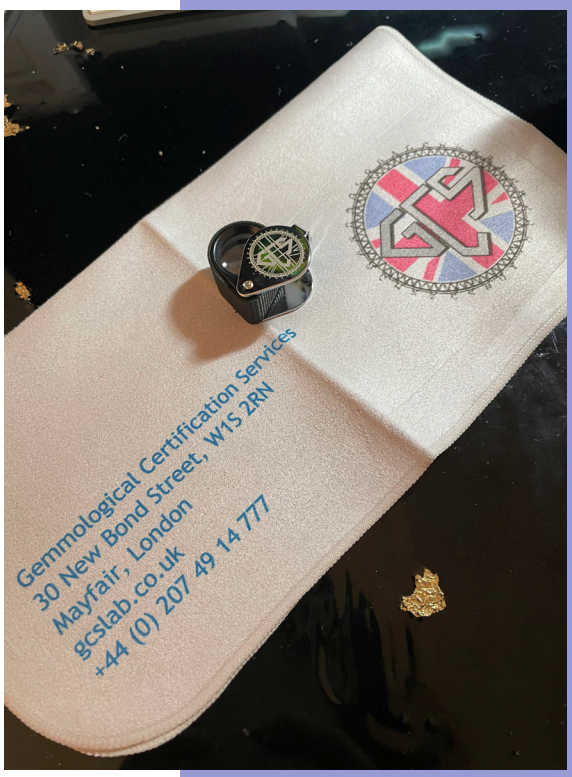
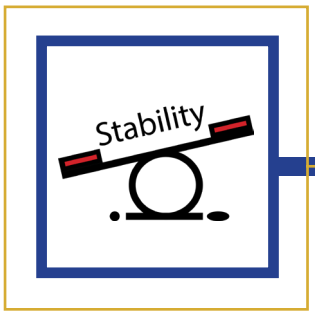
Gemmological Certification Services was established in the heart of London's Mayfair in 2014. We are the UK's leading gemmological laboratory for the origin determination of coloured gemstones; identification of synthetic material, including laboratory grown diamonds; differentiating natural and cultured pearls; and detecting treatment in all the major gemstones. Working in collaboration with Claude Bernard University in Lyon, France, we uphold a high academic standard, with a fully trained team of gemmologists and the most up-to-date technology. We are proud to provide gemmological certification services to the most prestigious jewellers and auction houses in the UK and worldwide.

Our parent company, the antique jewellery specialists, Gemroad had been established on the premises a decade earlier by Stephane Cohen-Scali, whose interest in gemstones stems back to his childhood, having grown up in the family jewellery business in Paris. France. As an interest in gemstones can only take one so far, Stephane went on to pursue his gemmological studies at the Institut National de Gemmologie and Claude Bernard University, obtaining a gemmological degree and diploma respectively. After founding Gemroad, Stephane, recognising a need for such a service, set up a gemmological laboratory in London.

The company is now managed by his daughter, Stephanie Seror, who has grown the team to three times its original size over the past year. With an experienced tutor on staff, we are now in a position to deliver gemmological education to the those with an interest in pursuing this fascinating and ever evolving subject.

Our pooled knowledge, coupled with our day-to-day operations as a laboratory, place us in a prime position to offer the most comprehensive level of gemmological education in the UK. We are looking forward to working with the World Gem Foundation.





PERMANENCE

The Liability of Stability

Throughout the ages, gemstones have been worn for personal adornment. This is why one of the key attributes of a gemstone, along with beauty, rarity, demand, tradition, and portability, is durability. Although many gemstones may possess one or more of these attributes, in reality, there are only a select few that truly qualify as gemstones from the thousands of minerals found in the earth. While there are many gemstones that sit in private and public collections, the vast majority are worn for enjoyment. This begs the question 'If you cannot wear it, why buy it?'

In addition to hardness and toughness, the third aspect of durability is stability. This relates to a gemstones ability to resist loss of colour dissolution by chemicals, or other forms of deterioration. For example, pearls can be damaged by weak acids, some turquoise tends to become greenish when it absorbs skin oils and acids, and several gems tend to fade in colour over a period of time. However, most of the important gems are very stable since they resist even concentrated acids and do not lose colour.

Heat-treated zircon, which tends to revert to a brownish colour, some amethyst and kunzite (both of which tend to fade), plus turquoise and pearl (for the reasons mentioned above) can be problematic. However except for those changes involving a loss or change of colour, avoiding deterioration simply requires proper care and attention.

We know that some gemstones are inherently fragile (opal, emerald, and tanzanite) and require special handling. If set into rings, how they are set becomes an important consideration. An opal set in a bezel setting will be infinity safer than one set in claws. Pendants and earrings also offer a higher degree of security. This is information that sellers of these gemstones must pass onto their customers. The same is true of goldsmiths and jewellers. Happiness is putting a clients emerald into an ultrasonic cleaner or steam cleaning it. Explain that to your customer when their precious gemstone is returned to them in pieces. But what about treated gemstones? How durable are they? Since every gemstone is unique and different, it is impossible to state categorically whether a treatment is permanent and stable. Therefore any references to permanency and stability, merely reflect what is generally accepted within the gemmological community, the trade, and by the various trade organizations.

If we look at the charts on the following pages, we can see that of all the treatments, heat treatment seems to be the most stable. Logically, this makes sense since all inorganic gemstones are formed under high temperatures. In fact, some people view it as an extension of the gemstone's formation, as the heat

Opals
(Photo by Tino Hammid)


Tanzanites (Cut by John Dyer)
(Photos by David Dyer)

could have been applied within the earth before they were mined. Heating can create a brittleness in a gemstone and can alter the inclusions, causing them to expand more than the host gem. This may cause cracks which could impact on their value and durability.

The HPHT (high pressure, high temperature) treatment of diamonds is also permanent and stable. Again the use of high pressure and high temperatures mirrors what happens deep within the earth.

Diffusion is a treatment that needs to be expanded and further explained. AGTA only have one code for diffusion (U). They define it as '*the use of chemicals in conjunction with high temperatures to produce ARTIFICIAL color change and/or asterism-producing inclusions*'.

CIBJO also uses one code (U) and define it as '*the diffusion of colour-causing or phenomenon-causing elements into a stone*'. Under Clause 4.2.5.2.2. Diffusion Treatment, they state *'Gemstones with a colour treated by, and/or an optical phenomenon created by, diffusion of chemical elements, with the exception of hydrogen and oxygen, from an external source.*

This may be true of the surface diffusion that was used in the past. These gemstones certainly are not stable since a simple repolishing will remove the micro-coating. However, sub-surface diffusion is different. It is stable and permanent and this needs to be listed separately with its own code. The universal use of a 'U' code to cover all diffused gemstones is not fair because to those with limited knowledge, it could be the 'kiss of death' for a gemstone.

However, as we move into radiation, glass-filling and surface modifications (such as oiling and waxing), we can see that the picture changes quite dramatically. Now we find ourselves dealing with a host of gemstones that when treated are not stable or permanent.

Radiation is another term that can kill a sale. It is hard to think of any 'sales encounter' where this term could be introduced without striking fear in the hearts of a potential buyer. While the U.S. Nuclear Regulatory Commission (NRC), established in 1974, is committed to protecting the health and safety of the public and the environment in civilian uses of nuclear materials, what about irradiated gemstones purchased overseas? Of the gemstones currenly irradiated to enhance their colour, almost 50% are considered unstable. Is this explained to a customer? Probably not.

Surface modifications on the other hand can never be permanent or stable. The very nature in which they are applied makes this impossible. Often introduced into cracks or fissures, it is safe to say 'what goes in must eventually come out'. This makes it impossible to predict how long they will last. Assertions made by manufacturers of epoxies and resins, such as Excel and Opticon, can claim that their products will not breakdown over a period of time, but in reality, it is difficult to make such claims and assertions since there is no universal data base that tracks this information and their long term durability.


Emerald (Muzo)
(Photo by Tino Hammid)

Should 'stability be a liability'? Not really but if you value your clients business, and want to ensure they become repeat customers, full disclosure must be made at the time of purchase, warts and all.

Gemstone Stability Charts

Resultant Gemstone	H	R	U (Surface)	U (Sub-Surface)	HPHT	B	D	F	I	Other
Amber									O	C
Andalusite										
Apatite										
Benitoite										
Beryl (Aquamarine)										
Beryl (Emerald)									O	
Beryl (Golden)										
Beryl (Green)										C
Beryl (Maxixe)										
Beryl (Pink)										
Beryl (Yellow)										
Chalcedony										C
Chrysoberyl (Alexandrite)									O	
Chrysoberyl (Cat's Eye)										
Coral (All Colours)									W	C
Coral (Black/Golden)										
Corundum (Black Star)										
Corundum (Blue)										
Corundum (Blue Star)									O	
Corundum (Colour Change)										
Corundum (Green)										
Corundum (Orange)										
Corundum (Padparadscha)									O	
Corundum (Pink)									O	
Corundum (Purple)										
Corundum (Ruby)									O	
Corundum (Star Ruby)									O	
Corundum (Yellow)										
Diamond										F, L, C
Feldspar (Red)										U
Fluorite (Purple)										
Garnet (Demantoid)										
Jadeite										Comb
Lapis Lazuli									O	W
Malachite										W
Opal									O, W	S, ST
Pearl										PC
Peridot									O	
Quartz (Amethyst)										Comb
Quartz (Ametrine)										
Quartz (Citrine)										
Quartz (Green)										
Quartz (Rose)										
Quartz (Smoky)										

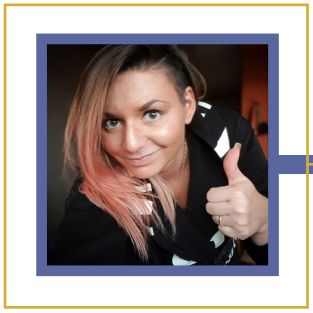
Resultant Gemstone	H	R	U (Surface)	U (Sub-Surface)	HPHT	B	D	F	I	Other
Quartz (Tiger's Eye)										
Shell										
Spinel										
Spodumene (Kunzite)										
Topaz (Blue)	A									C
Topaz (Golden Yellow)										C
Topaz (Green)										C
Topaz (Imperial)										C
Topaz (Orange/Pink/Red)										C
Topaz (Yellow)										C
Tourmaline (Bi-Colour)										
Tourmaline (Blue/Green)										
Tourmaline (Cat's Eye)										W
Tourmaline (Cuprian)										
Tourmaline (Golden)										
Tourmaline (Paraíba)										F
Tourmaline (Pinkish-Brown)										
Tourmaline (Red/Pink)									O	W
Turquoise									O	W
Zircon (Brown)										
Zircon (Blue)										
Zircon (Colourless)										
Zircon (Orange)										
Zircon (Red)										
Zircon (Yellow)										
Zoisite – Tanzanite										C

CIBJO KEY

Treatment/Enhancement	Code	Treatment/Enhancement	Code
Heat Treatment	H	Irradiation	R
Oil Impregnation	O	Dyed	D
Waxed	W	Coated	C
Impregnation	I	Bleached	B
Fracture Filled	F	Diffusion	U

ADDITIONAL KEY

Treatment/Enhancement	Code	Treatment/Enhancement	Code
Smoke Treated	S	Sugar Treated/Sulphuric Acid	ST
Polymer Coating	PC	Combination of Treatments	Comb
Laser Drilled	L	High Pressure High Temperature	HPHT
Permanent		Not Permanent	
Permanency Unknown			



COIN toss

What is the real price of a gemstone?

While every gemstone has its price, the price for the same gemstone can differ greatly, why?

In this article I want to cover the topic of gemstone pricing, its traditions and inconsistencies and answer the question 'What is the real price for a gemstone?'.

I have purposely avoided using prices in this article. Soon you will understand why.

While price reflects a gemstones position in the hierarchy of gems, it also gives us an indication of its value and availability but who regulates the prices?

Generally, this is done by international pricelists such as Rapaport, GemGuide, Gemval and by some respected gem laboratories but how is it possible that in the case of diamonds, the prices stated by Rapaport and GemGuide differ so much? (December 2022)

Description	Rapaport Price	GemGuide Price
.50 carat (D / IF)	BASE	-28%
.75 carat (D / IF)	BASE	-23%
1.00 carat (D / IF)	BASE	-27%
1.50 carat (D / IF)	BASE	-18%
.50 carat (G / SI-2)	BASE	-14%
.75 carat (G / SI-2)	BASE	-13%
1.00 carat (G / SI-2)	BASE	-12%
1.50 carat (G / SI-2)	BASE	-16%

There are many factors that influence the price of a gemstone; the mineral species and variety (i.e., tourmaline), the color, clarity, carat weight, whether it has been treated, its durability and stability, and of course its rarity.

Auction houses such as Sotheby's and Christie's regularly break and set records, showing that there is seemingly no limit to what people will pay. Here it is not just the quality of the gemstone but also its provenance, where a

gemstone of mediocre quality, set in a piece of jewelry with a great history or a connection with royalty or a celebrity can cost more than a top-quality gemstone of the same type. Price now has nothing to do with the gemstone. It has everything to do with its cultural heritage and significance.

Trade shows like Tucson, JCK in Las Vegas, and those held in Hong Kong, Bangkok and Singapore often create trends that can have a significant impact on price. In the world of fashion, they are always looking for the next 'Big Thing' to promote. Celebrities and the rich and famous often create demand for certain gemstones. Look at the surge in interest for blue sapphires when Prince Charles presented the now famous blue sapphire and diamond ring to Lady Diana. History repeated itself when Prince William gave the very same ring to his wife. We have observed this over the last 10-20 years with tanzanite, cobalt, and grey spinel, Paraíba tourmaline, black diamond, and many more. These trendy gemstones do not always meet the criteria for rarity, durability or even attractiveness but their 'trendiness' does influence their price.

If we look at the supply chain, we can see that as a gemstone goes from the mine to the store, the price changes several times.

Once it is mined, it assumes a price that increases as it is cut and polished. Often a gemstone will be cut more than once. For example, it may have been cut at the place where it was mined ('Native' or 'Commercial' cut) and require recutting to meet international standards. This additional weight loss will further increase the value.

The chart below shows how a decrease in yield affects the price per carat. If you have a rough gemstone that weighs 5 carats and it cost $ 100 USD a carat ($ 500 in total) and you cut it with a resulting yield of 40% (a 2 carat finished stone), the cost per carat will need to increase to $ 250 USD a carat. If that gemstone is then recut to 1.50 carats (a 30% yield from the original 5 carat rough), the price per carat will need to increase by 33% to recover the same cost (2 carat @ $ 250 per carat = $ 500 / 1.50 carat @ $ 333.33 per carat = $ 500).

Yield	Original Cost of the Rough (Per Carat)				
%	$ 2	$ 4	$ 8	$ 20	$ 100
50%	$ 4.00	$ 8.00	$ 16.00	$ 40.00	$ 200.00
40%	$ 5.00	$ 10.00	$ 20.00	$ 50.00	$ 250.00
30%	$ 6.66	$ 13.33	$ 26.66	$ 66.65	$ 333.33
20%	$ 10.00	$ 20.00	$ 40.00	$ 100.00	$ 500.00
15%	$ 15.00	$ 30.00	$ 60.00	$ 150.00	$ 750.00
12.5%	$ 17.50	$ 35.00	$ 70.00	$ 175.00	$ 875.00
10%	$ 20.00	$ 40.00	$ 80.00	$ 200.00	$ 1000.00

Of course, if it ends up in a 'branded' store such as Cartier or Tiffany, the price will again increase.

TO SIDES TO EVERY STORY

Price also varies depending on whether you are buying or selling. If you are selling, you will always see the gemstone through 'rosier' glasses. If you are buying, you will always seek out its 'shortcomings' because it is human nature to find ways to lower the price.

It is a game of 'Cat and Mouse'. Sellers nowadays inflate the price so that they can discount it. If you look at RapNet, you will see that very few diamonds sell for anything close to the 'Rapaport' prices. This leads to the real question 'If diamonds regularly sell at discounted prices to those stated on the Rapaport Pricelist, should the pricelist not reflect these prices?' After all, prices are set by what a person is willing to pay, not what a seller wants to sell it for.

Seller motivation also comes into play. In the past, sales were used to sell off slow moving items and replace them with fresh stock. It was all about recovering the costs so that they could be reinvested. Perhaps the price reflects the need to 'cash out' on a particular item that has proven difficult to sell at a regular price.

From the point of the buyer several factors are important: what is the buyer's previous experience, their knowledge of the market, do they plan to resell the stone or keep it for themselves. Is it a gift? Are they buying it as an investment?

Retail therapy also plays a role as does the 'mood' of the seller and the buyer. A customer may pay more simply because they want to satisfy a need.

COLOR

In terms of the actual quality factors that affect price, let's start with color.

The most expensive color for a blue sapphire is 'Royal Blue', but in fact this may not look as attractive in a setting as a 'Cornflower' blue because when set, the 'Royal Blue' may appear too dark. Lighting and geographical location can also influence the colour with different types of lighting either enhancing the appearance of the stone or being to its detriment. Colour preference is another key factor. For example, North American and European buyers prefer pearls that are white with a rose overtone.

Heat treated tanzanite that are an intense blue are more expensive than untreated tanzanite, yet the latter is natural while the other is not. Shouldn't an untreated tanzanite that displays trichroism be more valuable?

The presence of treatments usually lowers the price significantly, as is the case with natural rubies and sapphires but what about other stones where it is impossible to tell?

Tanzanite / Photo by Nina Zolotukhina

Aquamarine (Africa) / Photo by Tino Hammid

But don't you think that it is a matter of taste and fashion and who knows, maybe in future 'other colors of beryl' may cost as much as emerald.

Violet colored Paraíba tourmaline could even cost more than neon blue and if anyone finds a 'neon red' quartz, this could completely change the pricing of quartz.

I know it sounds like science fiction, but history has told us that we never know what the next trend or what the next newly discovered variety of an existing gemstone will be. Could anyone ever image tourmalines selling for such astronomical prices?

In the case of aquamarine, buyers typically gravitate towards bluer stones that have been heat-treated, while others prefer the warmer 'Sea foam green' that is completely natural. Because demand is higher for blue aquamarine, the price reflects the market preferences.

Diaspore from Turkey (aka 'Zultanite') has a color change effect from violet and green to pink and red just like alexandrite, yet the price is substantially lower even compared to other stones that display a similar property (i.e., color-change garnet and color-change sapphire). Of course, one can argue that alexandrite is rarer (or is it?) and has a richer history.

Some natural fancy-colored diamonds are incredibly rare and therefore expensive. Some even change color (chameleon diamonds) making them highly desirable especially for collectors. Irradiated diamonds, on the other hand, sell for a fraction of the price. They may have the same color and the same chemical composition, but they do not possess the same 'cachet for buyers. This is why, fancy blue and pink diamonds perform so well at auction. They are symbols of wealth and success.

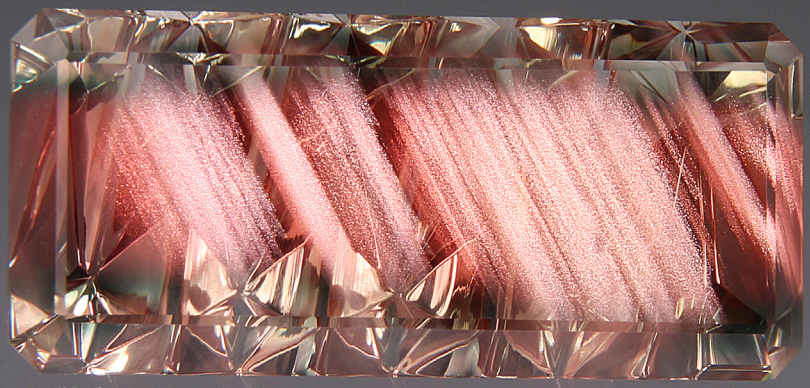
Emerald belongs to the 'Beryl' family that also includes aquamarine, pink beryl, yellow and golden beryl, colorless beryl, red beryl, and green beryl yet the prices for emerald far exceed those for other beryls. In the case of emerald and green beryl, the presence of chromium plays a huge role in the overall pricing. Buyers want emeralds, they do not want green beryl. This is why, some clever marketers have tried marketing red beryl as red emerald. Some have even tried doing the same to aquamarine, such is the power of the word 'emerald'.

COLOR CHANGING GEMSTONES

It is estimated that worldwide diamond deposits contain nearly one quadrillion tons of rough, yet we believe that they are rare. This belief has been cultivated by De Beers and their clever marketing campaigns that not only reinforce this belief but also compel us to express our love for another person with a diamond. They even told us how much we should pay for our diamond. The three-month rule stems from a marketing campaign the De Beers diamond company ran in the 1930s that sold the idea that true love and commitment could only be shown if a man spent a month's salary on his wife's ring and over time it evolved into two in the 80's and finally three months. Tacky, yes but it worked. However, if you want to express your true love for another person, why not give them a gemstone that is far rarer, such as a Burmese ruby, a Kashmir sapphire, or a Colombian emerald? If you want to take it to a whole different level, why not painite, benitoite, taaffeite, poudretteite, musgravite, jeremejevite, or serendibite? These are truly rare yet for many, they do not even appear on their radar.

De Beers also tells us that a 'Diamond is Forever', a claim that is centred on their exceptional hardness. The belief that diamonds are indestructible is false. Yes, they can scratch other gems, but this does not mean they

Sunstone (16.58 carats) ZigZag ™ Cut by John Dyer / Photo by Priscilla Dyer



are necessarily tough. Due to their octahedral cleavage, it is quite easy to break a diamond. De Beers don't mention this in their marketing!

CLARITY

And what about clarity?

Should not gemstones that are very clean be worth more than gemstones that have inclusions? Apparently not. Again, the industry has made us believe that an inclusion in an aquamarine (clarity type 1) is less desirable than a similar inclusion in an emerald (clarity type 3). Yes, we know that they grow under different conditions but do buyers take this into account? In the world of colored gemstones, color is still the main characteristic that influences the price.

Archduke Joseph Diamond (76.02 carats) / Smart Select

Inclusions are very subjective. Some people gravitate towards them, appreciating their uniqueness and beauty. Some notable photographers have made their living extolling the virtue of inclusions in gemstones. They can have an influence on price, especially if they are rare. They can have a beautiful shape or a unique position in the stone, which can create an amazing pattern inside the stone if faceted correctly. Look at amber and the added value certain insect inclusions can have on the overall price.

ORIGIN

If we take three diamonds of the same weight, clarity, and color, mined in different locales and under different conditions, will the price be the same? Let's take a diamond from a legal mining site in Africa that was picked up in a river, a diamond that was extracted from the MIR Kimberley pipe in Siberia, Russia using expensive equipment and in inhospitable circumstances (-50 degrees C) and an illegal 'Blood' diamond. Should they have the same values?

Maybe, you will tell me that this comparison is incorrect because there are no more 'Blood' or so- called 'Conflict' diamonds anymore after the Kimberley process took place in 2000 but we all know that is not true. 'Shadow' diamonds from Africa still exist as well as millions of carats of 'conflict' diamonds, hidden from sight in major world private storages. They did not just disappear from the face of the earth, and they certainly were not destroyed.

In colored gemstones, origin does play a significant role in pricing. If it can be proven that the stone comes from an historical location (Mogok, Burma, Kashmir, India, or the famed Chivor or Muzo Mines in Colombia), or is from a new, very small and uncommon location with little production, it will affect price. However, one only has to look at tanzanite to see that being exclusive to one geographical region (Tanzania) does not guarantee it will appreciate in value. From 2006 to 2022, the price of a three-carat 'Extra Fine' tanzanite dropped 15%., while

Mir Diamond Mine (Mirny, Sakha Republic, Siberia) / Sergey Subbotin/Sputnik

during the same period, Oregon 'Orange' sunstone dropped 22%.

CONCLUSIONS

As you can see, the price of a gemstone often breaks the rules and we cannot link it to a specific mineral specimen or to a gemstone's characteristics such as its rarity, color, clarity, or durability.

The price speech is a subjective speech…

We need to admit that the pricing for gemstones is an artificial process, which is not always logical and clear, but which often depends on big politics and specific mechanisms of the gem trade. It is a long and complicated road from the place where the gemstone was born to the place where it was first worn.

Some people choose the stone, some people choose the status and some look at gemstones as a perspective investment and all these viewpoints can affect the final price.

Supply and demand can be created artificially and spontaneously disregarding the previous experience and traditions of the gemstone trade.

Summing all the above and answering the main question posed at the very beginning of this article, it must be said that the 'real' price of a gemstone is the price a person defacto paid for it.

Sunstone (4.50 carats) Dreamscape[M] Cut by John Dyer / Photo by David Dyer

ABOUT THE AUTHOR

Nina Zolotukhina is an Expert Gemmologist through the MSU who is now based in Bulgaria. She is an avid mineral and gemstone collector, a photographer of minerals and inclusions (photomicrography) and Director of Corporate & Career Development for the WGF in Eastern Europe (Eastern Europe and Russia Gem Academy).

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

Kym Hughes
President NCJV

So become enlightened

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WGF team

Professionals at Work

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 creator of ColourWise.

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 lead to the formation of the Dutch Gem Academy.

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

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

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

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 (Säterglántan 2002) and Silversmithing (Tärna Folkhögskola 1996).

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

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 gemological laboratory 'Hardy's', followed by the installation of the colored stone and diamond cutting facilities in the jewelry school EIBMA.

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

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

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

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.

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).

Haimanot Sisay (Ethiopia) is a graduate of the World Gem Foundation and an opal cutter based in Addis Ababa. She is the Associate Editor of Gemmology Today and an instructor / tutor for the World Gem Foundation.

Wilma van der Giessen (Belgium) received her first diamond education from Mr. S. Asscher in 1980 and in 1983 graduated at the German DGemG in Idar Oberstein as a diamond professional. At the age of 18, she was introduced to the diamond world in Antwerp where she learned all about rough and polished diamonds. Two years later, in 1985, she received her FGA diploma and in 1991 graduated as a GG at GIA's headquarters in Santa Monica, USA. Traveling is one of her great passions and her teaching space is a true paradise for gemmology students because they have access to a great collection of both natural and synthetic gemstones. Wilma is an avid photographer of gemstone inclusions and nature.

MEET OUR TEAM OF PROFESSIONALS

Geoffrey M. Dominy
World Gem Foundation
Spanish Gem Academy

Leone Langeslag
Dutch
Gem Academy

Deborah Mazza
British
Gem Academy

Gérard Raphaël Quintin
South American
Gem Academy

Marie-Hélène Corbin
Gem Academy of Canada
Gem Academy of Belgium

Jack Ghazalian
American
Gem Academy

Dr. Laurent Massi
French Swiss
Gem Academy

Kyalo Kiilu
East African
Gem Academy

Salomon Lutumba
South Central African
Gem Academy

Barickeh Charles Kholifa Koroma
West African
Gem Academy

Nina Zolotukhina
Eastern Europe
& Russia

Haimanot Sisay
World Gem Foundation

Lucille Daver
Gem Academy of Canada
Gem Academy of Belgium

Dorian Fitchko
Gem Academy of Canada
Gem Academy of Belgium

Alisson Lemaire
Gem Academy of Canada
Gem Academy of Belgium

Caroline Gagnaire
Gem Academy of Canada
Gem Academy of Belgium

Wilma van der Giessen
Gem Academy of Belgium

Gamini Zoysa
Sri Lanka

Gamini Zoysa (Sri Lanka) is the Managing Director of Mincraft Company, a member of the Congress Committee and Communications Committee of the International Colored Gemstone Association (ICA), as well as serving as the organization's Ambassador to Sri Lanka, Executive Committee Member of the Sri Lanka Gem & Jewellery Association, Former President and current Executive Committee Member of the Gemmologists Association of Sri Lanka (GASL), Board member for the International Gemmological Conference (IGC), he holds a Master's Degree in Geology from the University of Moscow and Doctorate in Mineral Exploration from Delft University, Netherlands and is an FGA (Gem-A) and G.G. (GIA) gemological graduate.

WGF FACT FILE

Date Founded: 2015

Country of Incorporation: Canada

Corporate Structure: Not-for-Profit

Board of Directors: Yes

Executive Council: Yes (5 Members)

Head Office: Palma, Mallorca, Spain

Number of countries where our students live: 85

FB Followers: 17,702

Instagram Followers: 1,094

LinkedIn Followers: 1,227

Total Value of Scholarships Awarded: € 124.800

WGF directory

Who we are and how to find us

Academy Name	Website Portal	E-mail Addresses
World Gem Foundation	www.worldgemfoundation.com	information@worldgemfoundation.com
American	www.worldgemfoundation.com/aga	aga@worldgemfoundation.com
Belgian	www.worldgemfoundation.com/gab	infogembelgium@egmtl.com wilma@worldgemfoundation.com
British	www.worldgemfoundation.com/bga	contact@gcslab.co.uk
Canadian	www.worldgemfoundation.com/gac	info@igem.ca
Caribbean	www.worldgemfoundation.com/cbga	cbga@worldgemfoundation.com
Central American	www.worldgemfoundation.com/caga	caga@worldgemfoundation.com
Dutch	www.worldgemfoundation.com/dga	dga@worldgemfoundation.com
Eastern Europe / Russia	www.worldgemfoundation.com/eega	ninagold@worldgemfoundation.com
French-Swiss	www.worldgemfoundation.com/fsga	fsga@agat-gemology.com
East African	www.worldgemfoundation.com/eaga	eaga@worldgemfoundation.com
Indian	www.worldgemfoundation.com/iga	iga@worldgemfoundation.com
Scandinavian	www.worldgemfoundation.com/scga	scga@worldgemfoundation.com
South American	www.worldgemfoundation.com/saga	saga@worldgemfoundation.com
South Central African	www.worldgemfoundation.com/scaga	scaga@worldgemfoundation.com
Spanish	www.worldgemfoundation.com/sga	sga@worldgemfoundation.com
Sri Lanka	www.worldgemfoundation.com/slga	gaminiz@worldgemfoundation.com
West African	www.worldgemfoundation.com/waga	waga@worldgemfoundation.com

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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