

Gems & Jewellery

Winter 2019 / Volume 28 / No. 4

GEMS OF THE
URAL MOUNTAINS

TRAVERSING THE
SILK ROUTES

DIAMOND SECURITY
WITH OPSYDIA

BACK IN TIME WITH
REFRACTOMETERS



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THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN



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Gems & Jewellery

WINTER 2019

A JOURNEY TO RUSSIA

Dacques Nini GG PG JFT FCGmA shares his account of a recent trip to Russia, where he explored emerald and demantoid garnet mines in the Ural Mountains.



24



PRECIOUS GEMS OF THE SILK ROUTES

Inspired by her 20-year career in the gemstone and jewellery industries, Sandrine Martin GG explores the historic 'Silk Road' and considers its place in the fascinating timeline of gemstone trading between East and West.

WE CAN'T LIVE WITHOUT...

Can you imagine the field of gemmology without the refractometer? Here, Gem-A Instruments assistant, Sophie Cox, traces the history of this vital piece of equipment from the early 1900s to the present day.

38



Contributors	4	Diamond Technologies: Opsydia	28
CEO Comment	5	Gem-A Photographer of the Year	30
Gem-A News	6	Gem-A Student Project	32
The Big Picture: The Jade Market, Mandalay	8	Retail Focus: Lab-Grown Diamonds	35
Gem-A Conference and Graduation	10	Gemmology Research: Billie Hughes	36
Gem Empathy Award	15	John Benjamin on Topaz	40
Field Trips: Kenya	16	How Membership is Changing	42
Gem-A Voices	19	Magnificent Emeralds	44
Field Trips: Corgialenios Museum, Kefalonia	21	Last Impression: Hong Kong	46



COVER PICTURE

The winning image in the Gem-A Photographer of the Year Competition 2019: 'Microchip' by Evgenios Petrides is a photomicrograph of an iron oxide inclusion in a quartz specimen from Brazil.

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Gems & Jewellery

Winter 2019 featured contributors

1. DACQUES NINI

Founder of Dacques, a wholesale and bespoke jewellery company, Dacques Nini GG PG JFT FCGmA has travelled to over 40 countries in pursuit of the rarest and finest gemstones and coloured diamonds. Dacques has an insatiable appetite for excellence when presenting stones to his clients that they would never see in a jewellery store. After studying with GIA, Dacques completed courses in South Africa with Harry Oppenheimer in rough diamond evaluation, as well as the Graduate Diploma with the Canadian Gemmological Association.

2. CHRISTA VAN EERDE

Christa's passion for gemstones was instilled from a young age by her father, Albert, whose fondness for rocks and minerals led to her being named Christa Lynn, which combined makes 'crystalline'. She is a regular contributor to *Gems&Jewellery* and has also had work published in *Rock&Gem* magazine and on *The Jewellery Editor*.

3. DEBORAH CRAIG

Deborah Craig FGA DGA is a mining industry professional, with a focus on mineral exploration. She has a special interest in the mining of gemstones and has previously written for *Gems&Jewellery*

about the Chimwadzulu Hill sapphire mine in Malawi and the Aappaluttoq ruby mine in Greenland. Deborah is an advocate for women's increased economic empowerment and transparent and sustainable gemstone supply chains.

4. SAÚL CASTRO GÓMEZ

Saúl Castro Gómez Cert GA DGA is a graduate journalist with an interest in the public understanding of science, political science and energy. As an independent writer, his articles have been featured in the flagship magazine of the Organization of the Petroleum Exporting Countries, *OPEC Bulletin*. Currently based in UAE, Saúl aims to act as an independent consultant on diamonds for private and corporate clientele in the cities of Abu Dhabi and Dubai.

5. SANDRINE MARTIN

A graduate of the Ecole Supérieure de Gestion in Paris with a degree in marketing and international trade, Sandrine Martin studied at the Gemological Institute of America and became a Graduate Gemologist in 1996. Subsequently she obtained a diploma in jewellery design from AFEDAP in Paris and in Mandarin Chinese from Université Paris Diderot.

Over the years she has gained experience in diamond and coloured stone

trading, manufacturing and marketing of fine jewellery, wholesale and retail sales, estate jewellery, and in jewellery design. She has a passion for art, history of art and civilisations, and a deep interest in research and writing on topics of geology, gemmology and the history of jewellery.

6. HELEN SERRAS-HERMAN

Helen Serras-Herman FGA, a 2003 *National Lapidary Hall of Fame* inductee, is an acclaimed gem sculptor with over 34 years of experience in unique gem sculpture and jewellery art. Her award-winning artwork has been exhibited worldwide and published in over 200 trade magazine articles and books. Visit her website at gemartcenter.com

7. JOHN BENJAMIN

John Benjamin FGA DGA FIRV began his career in 1972 at Cameo Corner, the celebrated Bloomsbury antique jewellers. In 1976 he joined Phillips Fine Art Auctioneers as a cataloguer and valuer where he remained for 23 years, ultimately becoming international director of jewellery with responsibility for the sale programmes in London and Geneva. In 1999 he established his own jewellery consultancy John C. Benjamin Limited acting as an independent consultant for a private and corporate client network.

Straight from the heart

Opinion and comment from CEO, Alan Hart FGA DGA

We've had a whirlwind few months here at Gem-A HQ. Now that our feet are finally back on London soil, we are doing some last-minute preparations for this year's Gem-A Conference, which is sure to be a fantastic occasion. The Gem-A Conference 2019 will take place from November 2-5, incorporating two days of presentations at etc.venues County Hall, on the banks of the River Thames, an evening networking dinner at the Houses of Parliament, and two further days of museum field trips and workshops at Gem-A HQ. Our Conference continues to grow in size and popularity, and I am hopeful that this year will be our best yet. Thank you to all those who have purchased tickets, signed up to trips and put your name down on the list of workshop attendees – without you this important event in the international gemmological calendar just wouldn't be possible.

September is always a busy month for the Gem-A team. It's the month we welcome new students across our courses, but also when we attend two trade events: International Jewellery London (IJL) and the Hong Kong Jewellery & Gem Fair. The latter allows us to catch up with our Accredited Teaching Centres (ATCs) in the region, meet prospective and current students, network with colleagues and, of course, see some fantastic gemstones and jewellery. Gem-A is continually growing

its presence in Asia and we are proud of the strides we have taken over the last 12 months to make this happen. We look forward to welcoming a contingent of colleagues, Gem-A Members and students from across Asia to the Gem-A Conference and Graduation Ceremony in November.

Speaking of growth across the world, we are searching for the new head of Gem-A USA – an independent, non-profit entity established to offer Gem-A's world-renowned education in the United States. This individual will work with myself and Gem-A UK and USA trustees to develop a strategic plan for this important market and help to promote gemmology education in all 50 states. It's safe to say there are good things on the horizon for Gem-A USA!

Now, let's turn to the magazine you have in your hand. This is the last issue of *Gems&Jewellery* for 2019 and, in a change to previous years, we are plotting our next issue for very early 2020. There are some great features to sink your teeth into in this issue, including a trio of fantastic field trips to Russia, Kenya and the island of Kefalonia. Elsewhere, we take a journey on the historic 'Silk Routes' with Sandrine Martin GG, explore antique topaz jewellery with historian and valuer John Benjamin FGA DGA, and speak to Andrew Rimmer, chief executive officer of Opsydia, to discuss the business' fascinating diamond laser inscription technology.



I would also like to draw your attention to pages 42-43 which outline some of the ways we are striving to improve Gem-A Membership, both in terms of becoming a Member and the benefits of Membership. If you have any questions, please don't hesitate to get in touch with us.

All that's left to say is enjoy the rest of the year (even if it is already shaping up to be a tough winter), have a wonderful holiday season and a happy and healthy New Year. I look forward to welcoming you to the next issue of *Gems&Jewellery* in 2020.

Best wishes
Alan Hart FGA DGA



Meeting with representatives from our ATCs in Asia at our ATC Breakfast in Hong Kong.



Alan Hart with Rui Galopim de Carvalho and Enzo Liverino at International Jewellery London 2019.

PRECIOUS CORALS AND SUSTAINABILITY
Rui Galopim de Carvalho, FGA DGA
CIBJO Coral Commission

Gem-A News

A round-up of the latest news from Gem-A

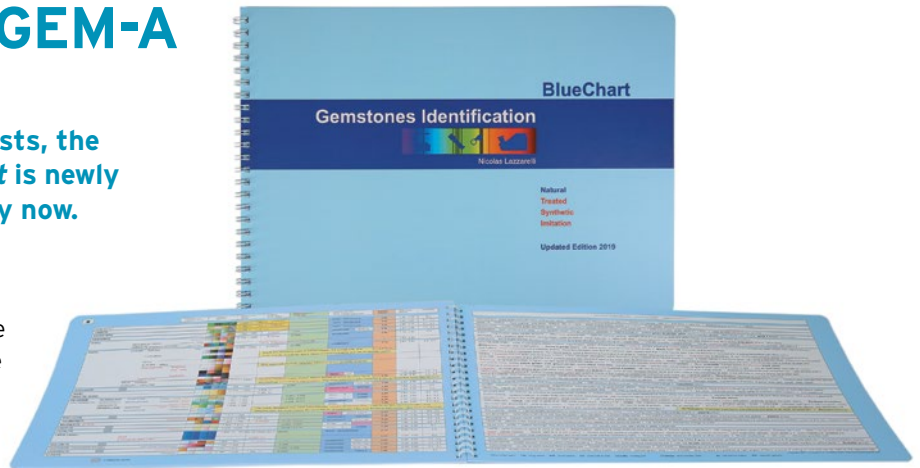
WHAT'S NEW AT GEM-A INSTRUMENTS?

Highly recommended for gemmologists, the *Gemstones Identification: Blue Chart* is newly revised for 2019 and available to buy now.

The 2019 edition of the *Gemstones Identification: Blue Chart* by Hervé Nicolas Lazzarelli is a comprehensive resource for identifying a wide range of gemstones and is a must-have for students and industry professionals alike.

The *Blue Chart* is packed full of key details including gem species, refractive indices, crystal systems, specific gravity, characteristic inclusions and common treatments, with colourful charts and diagrams for an informative and useful reference guide.

Notable features include updated information about common imitations, treatments and the best ways to detect them, for example, glass filling, which is so commonly used in the industry today. Classification of gemstones by refractive index makes it



quicker and easier to find the information and key facts you need.

The new and revised *Blue Chart* is available for RRP **£29.50** from Gem-A Instruments. Don't forget, current Gem-A Members and students receive a **5% discount** on books.

If you require any further information, advice or simply wish to purchase a copy, please email instruments@gem-a.com or visit our website at shop.gem-a.com. ■



Aye Ikomi



Jade Clark

GEM-A WELCOMES NEW ADDITIONS TO THE EDUCATION DEPARTMENT!

We are thrilled to announce that two new members of staff have joined the Education department at our London HQ. Aye Ikomi joins the team as student support and policy development officer. Aye comes from a background in third-sector education and has just completed a master's degree in educational psychology. Also with a background in educational charities, Jade Clark joins as our new education administrator. Welcome to the team, Aye and Jade!



GEM-A TO INSTATE A HEAD OF USA

We are excited to announce that the recruitment process for a head of Gem-A USA has commenced. The individual who takes on this new role will be responsible for establishing and developing the Gem-A USA headquarters and will manage Gem-A USA's activities in North America. We look forward to bringing you the news of this appointment very soon.

GEM-A AGM 2019

We are looking forward to welcoming Members to our next AGM, which will be held on Wednesday 30 October 2019 at etc.venues, The Hatton, 51-53 Hatton Garden, London, EC1N 8HN. There will be a drinks reception in The Emerald Suite, The Hatton from 6pm, with the AGM commencing at 6.30pm. There is no need to pre-register for the AGM; if you would like to attend please arrive at the venue before 6.30pm. For further information about the venue, please contact events@gem-a.com.

GEM-A'S JOURNAL OF GEMMOLOGY ACCEPTED INTO SCIE DATABASE

We're delighted to announce that Gem-A's *Journal of Gemmology* has been accepted into Clarivate Analytics' SCIE (Science Citation Index Expanded) database. The SCIE is a comprehensive academic database covering more than 9200 scientific journals across 178 disciplines and is a vital source of information for science researchers worldwide.

Commenting on this recent achievement, Editor-in-Chief of *The Journal of Gemmology*, Brendan Laurs FGA said: "The Journal's coverage in the SCIE reflects the high quality of the research and information that it contains, and this important step will help elevate gemmology even further within the scientific and academic community. I extend my heartfelt appreciation to *The Journal's* associate editors, authors and readers for their support in reaching this significant milestone."

You can read more about this landmark achievement for *The Journal* in the full press release on our website: <http://bit.ly/2OtgtOa>.



PRECIOUS CORAL IN THE SPOTLIGHT AT IJL 2019

Gem-A enjoyed a successful year at International Jewellery London (IJL) 2019. This year our stand was positioned in a new location right at the entrance to the venue. Our team ran gemmology training sessions and enjoyed meeting the next generation of gemmologists.

One of the special highlights of our time at Olympia was the much-anticipated presentation of this year's Gem Empathy Award. The top accolade was presented to Bingjie Zhao for her 'Trawling' ring, which featured a 12.9 carat precious coral cabochon as the centre stone (more information on the winning entry can be found on page 15).



The Gem-A team with Rui Galopim de Carvalho FGA DGA and president of the CIBJO Coral Commission and donor of this year's Gem Empathy stone, Enzo Liverino.



The 12.9 carat *Pleurocorallium elatius* cabochon which was awarded to Bingjie Zhao at IJL 2019.

The Gem Empathy Award presentation on Sunday 1 September was followed by Gem-A's seminar on 'Precious Coral and Sustainability' on Tuesday 3, which was hosted by vice-president of the CIBJO Coral Commission, Rui Galopim de Carvalho FGA DGA. Many IJL visitors gathered in the Catwalk Theatre to hear Rui explain the key differences between reef coral and precious coral, which is most commonly used in fine jewellery production. The seminar also discussed the rising use of new technologies to identify specific coral species, the regulations in place to prevent over-harvesting and the vital work being carried out by CIBJO to promote awareness and preserve precious coral. ■

The Morning Jade Market, Mandalay, Myanmar



Wim Vertriest GGA shares the story behind this arresting image of a female jade trader and provides insight into the early-morning trade in rough at the Mandalay market in Myanmar.

The morning jade market in Mandalay, Myanmar, is one of the main hubs for the Burmese jadeite trade. Before dawn, traders gather around the market to sell rough jade blocks. The absence of any ambient lighting makes the use of torches a much more efficient way to evaluate rough jade. After sunrise, finished goods like cabochons and bangles are the main product.

This young mother has been there since before daybreak with her child selling to the jade buyers walking past. Minutes after this photo was taken, she was still entertaining her child while fiercely negotiating the price of a high value rough jade piece with a Chinese customer. This photo demonstrates the strength of women and mothers in all levels of the gem and jewellery trade.

Wim Vertriest FGA GGA obtained an MSc in geology in 2014 at KU Leuven, Belgium, specialising in 'Geodynamics & Geofluids'. Vertriest's main focus was on ore geology, hydrothermal-magmatic processes and geochemistry, but he later became interested in coloured gemstones. Vertriest is currently supervisor of field gemmology at GIA, where he is responsible for sample collection and documenting the local gemstone dynamics in gemstone mining areas around the world. He has (co-)authored several articles on new gemstone localities, updates on existing mining localities, in-depth gemmological studies and treatment experiments. ■

Photo credit: Wim Vertriest GGA FGA



READY, SET, GO



The first weekend in November can only mean one thing... the Gem-A Conference has returned! For all those who've registered to attend, signed up to a workshop or committed to an evening at the House of Commons, here's what you can expect from our flagship event.

The annual Gem-A Conference is the very definition of a labour of love. You may think of it as two days of presentations on the bank of the River Thames, which it most certainly is, but there's much more to the Gem-A Conference than meets the eye.

For the Gem-A team, the Conference experience begins once our speakers arrive from all corners of the world. Their presence in London and willingness to share their experiences, knowledge and passion is what makes the Gem-A Conference a success year-after-year. In 2019, we are proud to welcome a diverse group of individuals whose specialisms range from diamond mining and exploration to photomicrography and coloured gemstone market analysis. Kicking things off on Saturday,



2 November is Charlton August, senior mineral resource manager at Namdeb Diamond Corporation (PYT). His presentation will delve into the Namibian diamond mega-placer – defined as a deposit containing a minimum 50 million carats of 95% or higher gem quality stones – as well as the extensive exploration work his team has conducted to support future mining activities.

August will be followed by Barbara Dutrow, a professor at Louisiana State University, who will discuss the 'many faces of tourmaline' and the ways this gemstone can 'record' the geological conditions in which it forms. Next, we will jump from tourmaline to gemstone activities in East Africa with Rachel Dery, director of communication and outreach at Gem Legacy, a non-profit dedicated to education, vocational training and local economies in East African mining communities. On the afternoon of Saturday, 2 November we will hear from two formidable experts, Fabrizio Nestola and Nathan Renfro, who will share what diamonds can tell us about ancient oceans and the secrets of photomicrography, respectively.

On Sunday, 3 November, Anette Juul-Nielsen will start the day with a fascinating description of gemstone

mining and prospects in Greenland, followed by an analysis of coloured gemstone market trends from the knowledgeable mind of Richard Drucker. Further speakers will take to the stage in the afternoon before Laurent Cartier, project manager at the Swiss Gemmological Institute SSEF, rounds off the day with fascinating insights into artisanal diamond diving in the Sewa River in Sierra Leone.

Anyone who has attended the Gem-A





AT A GLANCE: THE GEM-A CONFERENCE SCHEDULE

Stay tuned to the Gem-A website and our social media channels to discover further speakers, due to be announced in the lead-up to the Conference.

When: 2-5 November, 2019

Where: etc.venues County Hall, London

Saturday 2: Charlton August, Barbara Dutrow, Rachel Dery, Fabrizio Nestola, Nathan Renfro

Conference Dinner: Strangers and Members' Dining Room, House of Commons, Westminster

Sunday 3: Anette Juul-Nielsen, Richard Drucker, Dr Laurent Cartier

Monday 4: Workshops at Gem-A HQ hosted by Rui Galopim de Carvalho, Laurent Cartier, Pat Daly and Richard Drucker

Tuesday 5: Field trips including a private viewing of the Crown Jewels at the Tower of London, a behind-the-scenes visit to the Natural History Museum and its earth sciences department, and a private tour of the Indian gallery (with a chance to handle objects) at the Victoria & Albert Museum.

Conference in the past will know that there's plenty more on offer, including the must-attend Conference Dinner. This year, our prime networking occasion will take place at the House of Commons in nearby Westminster. Many of you have already opted to take a tour of the Houses of Parliament before dinner, and we hope you enjoy this insightful and educational dive into British history.

On Monday, 4 November, we will throw open the doors of Gem-A HQ for our annual series of workshops, led by Conference speakers, our in-house specialists and invited guests. This year, Laurent Cartier and Richard Drucker will host hands-on workshops on developments in cultured pearls and the colour grading of gemstones, respectively. Anyone who wishes to brush-up on visual optics will benefit from the expert eye of Gem-A senior gemmology tutor, Pat Daly, who will boost participants' skills and introduce a new hand-held instrument - the Spectroaid, nicknamed the 'Judy-Scope' — which was developed by a former Gem-A student. Finally, Rui Galopim de Carvalho will host a workshop on precious coral identification for all those who missed his informative seminar at International Jewellery London 2019.

Of course, no Gem-A Conference would be complete without our gem-themed private tours. Conference attendees who have opted to attend this year's trips to the Tower of London, the Natural History Museum and the Victoria & Albert museum are no doubt looking forward to going behind-the-scenes at such prestigious institutions. These excursions quickly sell-out each year and offer unrivalled, hands-on access to some of the world's most unique specimens and historic objects. If you've missed out this

year, put a note in your diary for Conference 2020 to make sure you are one of the first to sign-up.

To all those who have registered to attend the Gem-A Conference, we look forward to welcoming you to London for plenty of inspiration, ideas and a little reminder about why we are all passionate about gemmology. ■

Can't make it to this year's Gem-A Conference? Follow the action on social media, including our Facebook (Gem-A) and Twitter (@GemAofGB) pages or visit gem-a.com/event/conference

DON'T FORGET!

What: The Gem-A Graduation and Presentation of Awards

When: 4 November, 18:00-21:30

Where: The Royal Institution of Great Britain

Students eligible to attend the Graduation ceremony have been sent an invitation via email. If you would like to attend please follow the instructions in the email and register your place on Eventbrite. If you haven't received the email please contact events@gem-a.com.

A BIG THANK YOU

We would like to take this opportunity to thank all the sponsors of the Gem-A Conference 2019, including Gold Sponsor Jewelry Television (JTV), Silver Sponsors Marcus McCallum, the Canadian Gemmological Association (CGA) and the Accredited Gemmologists Association (AGA) and Bronze Sponsors Ruppenthal UK, Crown of Light, Allied Gemmological Institute and Laboratory (AGIL), École de Gemmologie de Montréal (EGM) and Gemworld International.



1: Lines reminiscent of a 1950s' Cadillac: the town of Asbest has a charming welcome sign, "Asbest, your town and your destiny."

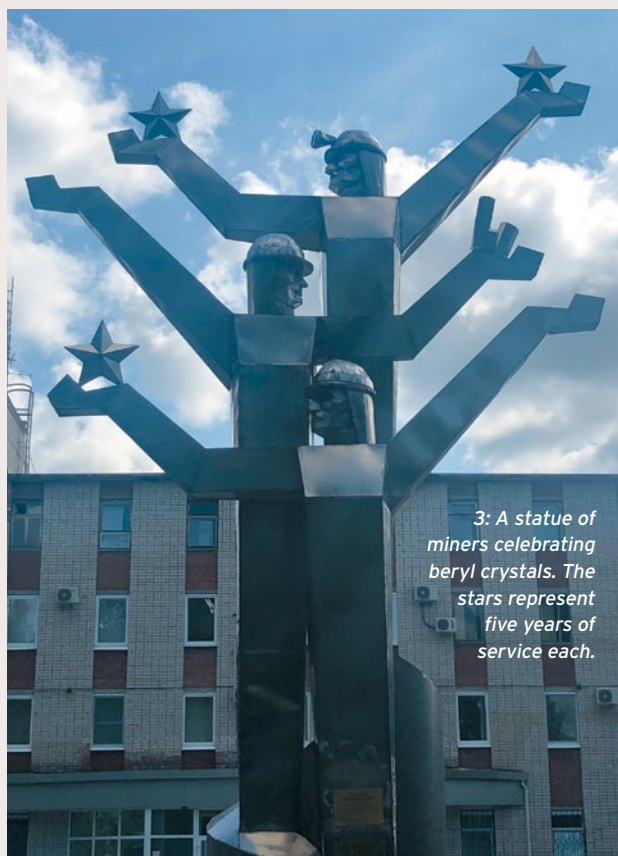
A JOURNEY TO RUSSIA

Emerald mining in Russia has had a turbulent history, from being an important source in the 19th century to a by-product of industrial development under the Soviet regime. Today, coloured gemstone mining is active in Russia, so when I was offered the opportunity to visit some of the world's most famous emerald and demantoid garnet mines, there was no hesitation.

As thoughts of embarking on this journey mounted, I could not help but reflect on the advances in knowledge by the 'greats' in our industry, from the likes of Shipley, Liddicoat and Sinkankas early in the United States, to Barnett, Webster and Anderson in Britain, among many others. More recently, Hodgkinson, Koivula, and Hughes each having opened the door of knowledge a little wider thanks to their first-hand writings on gem testing, inclusion research and field expeditions.

After arriving in Moscow, Peter Lyckberg and I joined a group from the Moscow State University Gemmology Department, headed by Yuri Shelementiev, en-route to Ekaterinburg. The goal of our trip was a visit to the emerald and demantoid garnet producing areas

Dacques Nini GG PG JFT FCGmA shares this account of a recent trip to Russia, where he explored emerald and demantoid garnet mines in the Ural Mountains.



3: A statue of miners celebrating beryl crystals. The stars represent five years of service each.

in the Ural Mountains. Early Uralian miners did not follow the belief of Pliny the Elder who embraced value as an overall qualifier in gems. The term 'precious stone' was rejected as it gave greater merit to the economic worth of a mineral versus the aesthetic properties of beauty, shape, and form. Instead, they used terms such as 'Samotsvety' (Self-Shining), and 'Tsvetnoy Kamen' (Coloured Stone) for opaque materials.

Emeralds were sourced near the Red Sea in antiquity. In the 16th century, the Colombian Andes revealed green glory from the Chivor deposits and changed the world market forever. In the 19th century, the world's most important modern emerald deposit was discovered in the Ural Mountains and I was about to get a glimpse into this part of gem history.

THE MARIINSKY EMERALD MINE

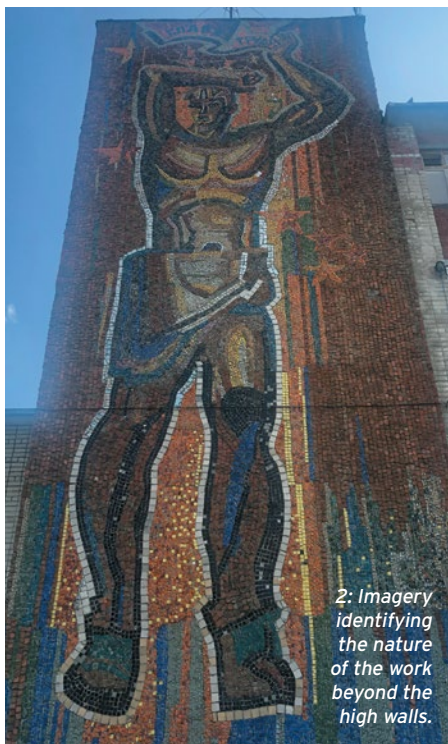
First on our mine trek was the Mariinsky emerald mine, formerly known as the Malysheva mine, located near the Malysheva urban locality, about 90km northeast of

Ekaterinburg. It is thought to contain some eighty per cent of the Ural's total emerald deposit. The geological classification of emeralds in the Urals area is an endogenic group with greisen class type deposits. The Izumrudnye Kopi is a region known for six major deposits. At the Mariinsky deposit, emeralds accumulate in disseminated mineralisation in prismatic or flattened crystals up to 5cm. To reach Malysheva, we drove through Asbest, a town that reminded me of the 1950s (1).

Upon arrival at the mine entrance, we were welcomed by a five-story mosaic of an emerald miner (2). Additionally, there was a sculpture created out of aluminium, which celebrates the miner and identifies three stars in recognition of the length of service—five, ten, and fifteen years (3). Included in the sculpture is a beryl crystal with hexagonal growth structure. After clearing security, we enjoyed a discussion about the mine and were shown articles memorialising the long history of the mine and its workers.

Our journey then took us to an original mine entrance at the centre of a quarry. Even though it is now filled in, we could see that it was well built and still well defined (4 & 5). The incredible tall pine forests of the region were utilised throughout the formal mining areas as well as in the artisanal mining efforts to provide support beams. Heavily oxidized and rusted equipment remained at the entrance and in the depths of the old mine, which overlooks the open pit where much emerald mining took place from the mid-1950s to 1971.

After a short bus ride, we visited a



2: Imagery identifying the nature of the work beyond the high walls.

While demantoid comes from other locations around the world, Russian demantoid is known as the finest the Earth has produced.

sorting house where rough was processed on conveyer belts, and then sent to cobbing stations for crystals that were collected from day-to-day production. We observed large crystals of approximately 100 to 300 grams in the cobbing offices. The lightly saturated colours ranged from transparent to translucent crystals. We were not allowed to take pictures inside.

DEMANTOID GARNET MINES

'Anthrax' was the term used in biblical literature, as well as by Pliny the Elder, to denote garnet. While the use of garnet in jewellery dates back thousands of years, two varieties of garnet stand out in modern jewels: tsavorite and demantoid. The chemical composition of the garnet group is based on isomorphous substitution varying between magnesium, iron, manganese and calcium, and transition elements such as vanadium, chromium and titanium. Andradite is an important end member of the six main varieties of the garnet varieties.

Demantoid's highly dispersed green colour is the result of chromian andradite with a small substitution of uvarovite, as a result of the joint chromophore action of chromium molecules and iron ions in octahedral coordination. Yellowish and brownish tints are a result of the iron substitution in the tetrahedral position and probably by titanium (Platonov 1984).

The first deposit of demantoid was discovered in 1855 in Nizhny Tagil, which was a placer deposit in the →



4: An old mine entrance that is no longer in use stands as a testament to how the forest reclaims the landscape with time.



5: Peter Lyckberg (right) and Dacques Nini standing upon tailings outcrop with a view of the most current mining area in the distance.



6: Demantoid garnet mine in Poldnevaya area, near Kladovka village, 32 kilometres north of Karkodino.

Ural Mountains near the village of Elisavetinskoye. A second deposit was found in the Vernknyaya Lhirzolitka River near the town of Poldnevsky. Dating back to 1874, it revealed the finest demantoid material. The chromium and aluminium contents were higher in comparison to the gems found in Nizhny Tagil.

While demantoid comes from other locations around the world, Russian demantoid is known as the finest the earth has produced. Within Russia, there are three mining areas of note: Klodovka, Karkodino, and Babrovka (6). Klodovka has produced material known for saturation in medium tones, which do not require heating. Karkodino produces highly saturated colours with dark tones, of which much is heated to diminish the effects of dark tones, thus giving a pure vivid green after heating. The Babrovka mine produces gems with less saturation, while exemplifying demantoid's incredible high dispersion (7).

In 1889, the International Paris Exhibition showcased these new jewels to the world. Today, there is a new name for the first deposit, now known as the Bobrovka deposit. While attending a discussion on demantoid garnet, I saw a wide selection of faceted stones exhibiting a diverse range of the demantoid colour, which ranges from emerald-green, bluish-green to bright grassy-green to pale apple-green (8). The finer emerald-green or bluish-green hues may have a yellowish tint due to inclusions, colour zoning, colour rims and darker cores. Greenish yellow, brownish, brown, brownish yellow colours were all observed.

7: Sure-footed and perched high on a rock face, hammering mother rock in search of demantoid garnet.



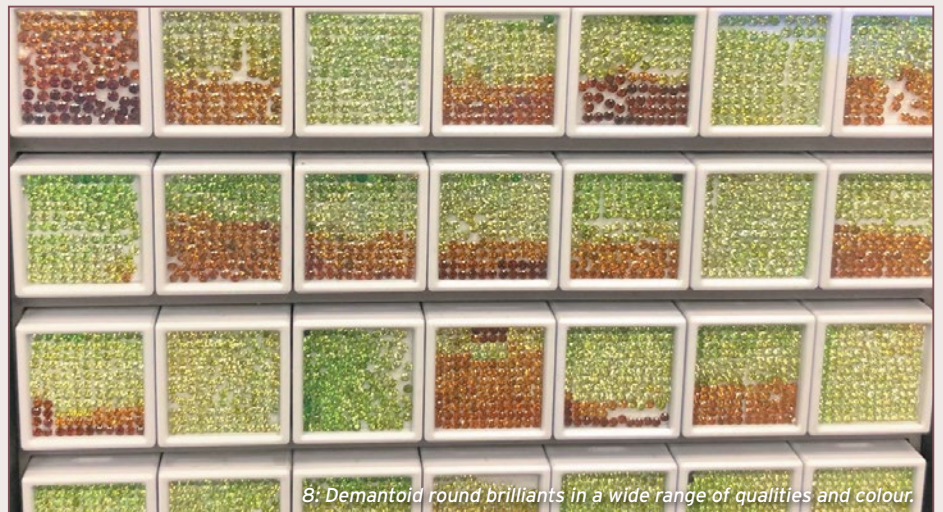
Demantoid has a wide variety of inclusions including other garnets, chromian spinel, magnetite, and asbestos. Asbestos describes any mineral that is extremely fibrous and flexible. Serpentine is a group of related polymorphous minerals with main members, of which antiorite represents solid forms and chrysotile represents fibrous forms. Fibrous chrysotile is a type of asbestos that is represented in demantoid. However, the radiating fibres of byssolite asbestos (fibrous amphibole) produce the golden yellow horsetail, which is the true prize. Byssolite is composed of tiny, interwoven, fibrous crystals that form a hair-like mass, sometimes surrounding a chromite grain producing the horsetail effect. Italy and

Iran also produce demantoid, but these gems typically display flat crystal faces. It is the horsetail effect that indicates a prestigious Russian origin.

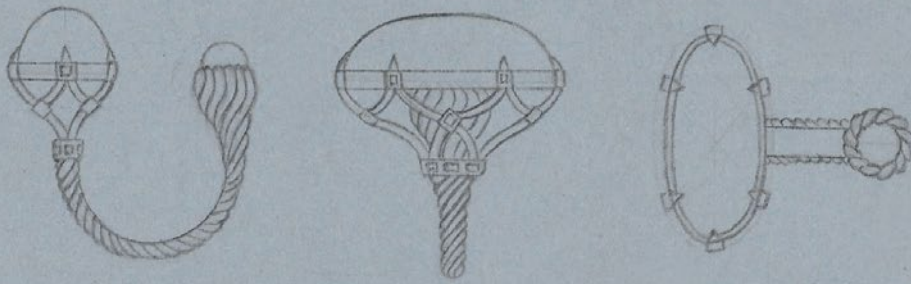
Although demantoid garnet can benefit from heat treatment, it is important to note which labs provide an opinion on origin and heating. Making a heat-or-no-heat call is difficult. While heating achieves some quality results, one lab shared the opinion that research in heating has not produced key points that can determine heat treatment with substantial accuracy. At this time, making the call on heating is rather subjective. The temperature involved is considered low or medium. Each species has its own unique temperature ranges for heat application. As an example, corundum can be heated to as high as 2000 °C. Demantoid would melt at this level. Heat treatment generally occurs at around 700°C, and converts the brownish-green gems into a more pleasing green.

American labs such as GIA and AGL say that they can determine heat treatment, but only AGL offers country of origin. Similarly, in Europe, the Gübelin Gem Lab and the Swiss Gemmological Institute SSEF also differ on what they offer. SSEF states country of origin and indications of heat treatment, while Gübelin will only report on heat treatment.

In conclusion, I would like to say that we were well received at both mining areas. These visits gave us a good glimpse into the life of the miners in the Urals, which don't differ significantly from others in mining. They all seek to earn a living producing gemstones that are appreciated around the world. ■



8: Demantoid round brilliants in a wide range of qualities and colour.



The winning design: Bingjie Zhao's 'Trawling'.



And the Award goes to...

The much anticipated winner of the Gem-A Gem Empathy Award 2019 was finally announced on September 1 at International Jewellery London. This year the award went to Birmingham School of Jewellery student Bingjie Zhao for her fabulous ring design: 'Trawling'.

Zhao's winning piece perfectly incorporated this year's prize gemstone, a 12.9 carat precious coral cabochon donated by Enzo Liverino 1894, a manufacturer of sustainable precious coral jewellery. The creative, asymmetric design also features a single pearl and 20 small diamonds in an 18ct yellow gold setting.

The award, along with the prize gem and a voucher to contribute towards the ring's construction, was presented by chair of the Gem-A Board of Trustees, Justine Carmody.

Detailing the inspiration behind her design, Zhao explained: "I chose the shape of fish nets and the texture of ropes as elements that represent trawling. I want to raise awareness of trawling problems through this piece of jewellery as well as reference the sustainable source of this precious coral."

In previous years, the Gem Empathy competition was only enterable for IJL exhibitors. However, this year, the competition was opened up to all IJL exhibitors and visitors, resulting in a swathe of fantastic entries from both students and professionals.

Zhao's winning design saw off tough competition from other entries in the final shortlist, including Eli Zhang's 'The

Gem-A's Gem Empathy Award 2019 received an array of stunning entries, but one outstanding student designer really swept the judges off their feet.



Dreaming Jellyfish', a design for a gold ring with the precious coral as the centre stone surrounded by 222 small diamonds; Ioannis Chatzipanagiotou's 'Sea Flame' featuring the coral cabochon with black diamonds in a white gold setting, which could be worn either as a pendant or



Bingjie Zhao is presented with her award by the chair of Gem-A's board of trustees, Justine Carmody, alongside Helen Clifford, marketing manager, International Jewellery London.

brooch; Cathie Osborne's design for a blue rhodium ring featuring the cabochon in a seabed of recycled PET alongside an Akoya pearl in 'Rainforests of the Sea'; and Wan-Yi Lin's 'Goldfish Girl' pendant design, which placed the cabochon alongside precious gemstones and enameling in an 18ct gold setting.

The panel of judges, which included Gem-A's CEO, Alan Hart, editor of *Retail Jeweller*, Ruth Faulkner and jewellery advisor and founder of Gemologue, Liza Urla, were completely won over by Zhao's innovative use of the precious coral.

We cannot wait to see what comes next from this talented young designer. ■

7: Christa Van Eerde climbing out from a mine tunnel. Photo courtesy of Christa Van Eerde.

A Sustainable Experience

Gems&Jewellery contributors Christa Van Eerde FGA and Deborah Craig FGA report on their recent visit to Kenya to discuss challenges, opportunities and sustainability issues in the coloured gemstone trades of East and Southern Africa.

First up on our trip to Kenya was a forum entitled 'East and Southern African Coloured Gemstones – From mine to market – challenges and opportunities' (at the Southern Sun Hotel, Nairobi) sponsored by Australia's Minerals and Energy for Development Alliance (MEfDA).

The organisation helps emerging resource economies grow their mineral and energy sectors and provides advanced educational opportunities to extractives professionals around the world. The forum was an opportunity for MEfDA's African alumni, as well as multiple stakeholders from industry, academia, civil society and government, to meet and discuss the issues impacting coloured gemstone supply chains (1).

The forum was preceded by a day of gemmological training for selected participants, entitled 'A Basic Guide

to Gemmology & Its Use in the Field', with Charles Lawson and Zo Harimalala providing instruction (2). Following this, there were two days of presentations, discussions and working sessions around issues relating to the coloured gemstone industries of East and Southern Africa. The main topics discussed were the need for a simplification of permit and licensing processes; more friendly and competitive import and export regulations; improving the supply chain to improve livelihoods and alleviate poverty; banishing preconceived notions that gem producing countries can't cut their own gemstones; female equality, gender balance and precedent-setting women's associations in Cameroon and Zambia; an overreliance on 'guesswork' to find the next tsavorite deposit – though geologically

problematic due to the irregular nature of the pockets, tsavorite would benefit tremendously from a single, large-scale operator, like there is for tanzanite (TanzaniteOne).

The forum included the Gemfields-sponsored 'Inspire' pitch competition, designed to encourage



4: Tsavorite rough from Taita Taveta. Photo courtesy of Charles Lawson.



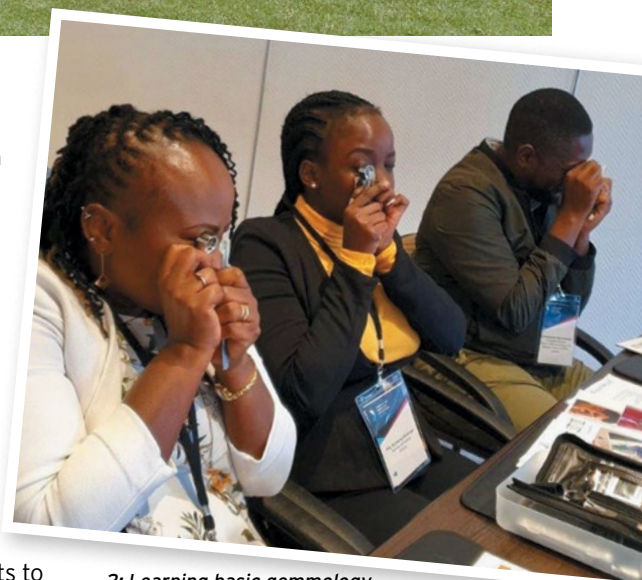
1: Participants of MEfDA's Forum on Coloured Gemstones.
Photo courtesy of the Mining Alumni Network.

new ideas about marketing coloured gemstones. Six competitors took the stage to present their ideas to a panel of three judges that included Algy Strutt, projects manager at Gemfields. Domoina Ranjatoelina of Madagascar and Canada triumphed with her 'African Gems Portal', receiving \$10,000 dollars to bring her idea to life (3).

Ranjatoelina explained: "The African Gems Portal will be an online platform where gemstone vendors and buyers can safely, formally and ethically interact, trade, and network with each other, while becoming educated about the industry. The platform will provide tangible long-term solutions to corruption and the

unfair practices that are occurring in the East and Southern African gemstone mining industry, through the integration of technology and social media."

Before the forum closed, sub-groups discussed specific challenges and what each participant could do in their sphere of influence to make the sector more ethical, responsible and transparent. We joined a working group which identified the lack of accurate and accessible geological data as a problem and advocated for local governments to keep digital geological data updated and



2: Learning basic gemmology.
Photo courtesy of the Mining Alumni Network.



3: Judges Monica Gichuhi and Algy Strutt with winner Domoina Ranjatoelina. Photo courtesy of Mining Alumni Network.

available online. Other proposals included displaying geological data at trade fairs, assigning a government geologist to areas of gemmological interest, and developing bespoke geological training programs for gemstone miners.

We also took part in a discussion group concerned with the footprint of artisanal and small-scale mining (ASM). It was agreed that unless formalised, people will not invest the time, energy and effort to rehabilitate lands. Suggestions included developing an EPF (Environmental Protection Fund) in all countries to share best practices, raise environmental awareness and conduct training to help people understand why it is important in our current global climate emergency. There is a necessity for collaboration among those with reach and know-how, training and follow-up. →

How wonderful would it be to wear a creation and know the story behind the gemstone(s) within it, the countries it has travelled and whose hands it passed through?

After the forum, The Association of Women in Energy and Extractives in Kenya (AWEIK), in partnership with the Republic of Kenya and the Chicago Responsible Jewelry Conference, held their annual Kenya Gemstone and Jewellery Fair (at the Movenpick Hotel, Nairobi). The two-day event hosted women miners displaying their rough stones, as well as local gem dealers, and a day of presentations on sustainability issues. The key take-away was that consumers want responsible jewellery, which implies certification and traceability. They are demanding transparency, something the sector cannot afford to ignore, and which should help to eliminate a major issue facing ASM: smuggling, theft and illegal activity. Government support is undeniably essential to support education and promote collaboration between local,

national and international economies.

We then journeyed to the heart of gemstones, Taita Taveta, and visited the artisanal Precious Women's Mines and Awongo CBO Mines, which excavate tsavorite, and tsavorite and tourmaline, respectively (4 – 7). The former has 39 owners, the majority of whom are women. The global coloured gemstone market is estimated to be worth between £15 and £17 billion, and three quarters of it is mined by independent artisanal miners and small-scale operations. ASM employs approximately 30-50 million people worldwide; 30-40% are estimated to be women. Of the 10,000 miners in Taita Taveta, about 15% are women. A traditionally male-dominated industry, the importance of women being supported in the sector became immediately apparent.

Venturing inside a newly excavated and narrow tunnel in the mine, the emotional impact was profound. The miners work with crude methods, rudimentary tools and risk their life daily in search of green garnet. One needn't go far to feel the temperature rise and struggle to take a deep breath. As difficult as it was to swallow the contrast between the experience and the shiny, sparkly finished product in a jewellery showcase, what struck most hard was not the jack hammer, but the opportunity for formalisation to lead to traceability and ethical sourcing. How wonderful would it be to wear a creation and know the story behind the gemstone(s) within it, the countries it had travelled and whose hands it passed through? ■

**Spotlight on:
Tsavorite Garnet**

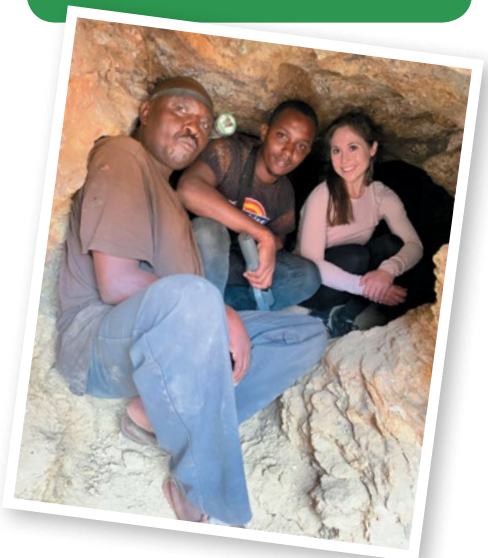


Colour: Green
Hardness: 7 - 7.5
Chemical Formula: $Ca_3Al_2Si_3O_{12}$
Mineral Group: Grossular Garnet
Crystal System: Isometric
RI: 1.738 – 1.745
SG: 3.6
Trace elements: Chromium or vanadium
Fluorescence: Typically light yellow

Discovered by Scottish geologist Campbell R. Bridges in northern Tanzania in 1967 and then in the Tsavo region of Kenya, tsavorite was introduced to the market in 1974. Tragically, Bridges was murdered in 2009. The Scorpion Tsavorite Mine re-opened in 2015 and is currently run by Campbell's son, Bruce Bridges.



5: Inspecting rough gemstones. Photo courtesy of Christa Van Eerde.



6: Christa Van Eerde with a miner and guide at the entrance to the mine tunnel. Photo courtesy of Christa Van Eerde.



“One of the most significant crystal discoveries ever made in the Alps.”

Gem-A President Maggie Campbell Pedersen FGA ABIPP reflects on a recent trip to Bern, where she had the opportunity to study tortoiseshell with a renowned furniture restorer, as well as visit an astonishing collection of quartz crystal.

As part of the research for my next book, *Tortoiseshell*, I spent a couple of days during the summer in Bern, Switzerland. I went specifically to meet and talk with a renowned furniture restorer by the name of Ulli Freyer, who has thirty years' experience of the craft and has worked on a lot of pieces with tortoiseshell veneer or marquetry. As I mentioned in a previous article in *Gems&Jewellery*, it is of immense value to talk to people face to face, rather than relying on books or the internet for information.

Turtles are a threatened species and tortoiseshell is today covered by strict regulations very similar to those regulating ivory. Tortoiseshell comes mostly from hawksbill turtles, but some material from green and loggerhead turtles has also been used. All marine turtles are listed on CITES Appendix I.

My visit to Mr Freyer's studio was kindly arranged by Michael Hügi, Director of SGS, the Swiss Gemmological Society, and together we spent a day discussing this beautiful material. Mr Freyer had found that working with the material awakened a desire to learn a lot more about it, including why and how it reacted to various treatments. Today this is of more historic interest than practical, but too often when a material is banned the art of working it becomes lost and within a few years nothing is known about how it was actually done. By talking and writing about it there is hope that the knowledge will not be gone forever.

Switzerland is a long way from any areas where marine turtles can be found, but the Swiss Alps hide many fascinating

and spectacular minerals, notably quartz. Michael Hügi alerted me to the fact that the Natural History Museum in Bern has a fabulous display of quartz crystals, so a visit to the museum was an opportunity not to be missed — especially as the museum was cool, and outside it was one of the hottest days of the year!

These quartz crystals started to form about 15 million years ago, deep

underground and at temperatures of around 300 – 400°C, and were lifted and cooled as the Alps developed. As Michael says, “The crystals have been collected since prehistoric times. There have been tools found made of sharp rock crystal pieces. From Medieval times to the Renaissance period, big and clear crystals have been recovered and traded as raw material for the lapidaries in Milan and Prague, where wonderful carved objects of art have been produced.”

In the early 2000s two mineral collectors, Franz von Arx and Paul von Känel, were working a site on Planggenstock, a mountain in the Canton of Uri, where they found interesting crystals such as large pink fluorites and smoky quartz. In 2005-6 they opened a deep cleft in the rock and discovered nearly fifty unusually clear, very large, perfectly formed quartz crystals. It proved to be one of the most significant crystal discoveries ever made in the Alps.

The total weight of the crystals is almost two tons, and the largest crystal cluster (pictured) weighs 300 kg. The largest crystal in the cluster is 107 cm long and has a diameter of 34 cm.

In 2010 the whole collection was acquired by the Natural History Museum in Bern where it is on permanent display in a purpose-built room.

I have endeavoured to find something to connect tortoiseshell and quartz for this article, but with two such disparate materials it proved virtually impossible, apart perhaps from the fact that, in past centuries, both have been used to make similar objects, such as snuff boxes. Two very different materials, but both equally fascinating. ■



The largest crystal cluster in the Planggenstock collection, weighing 300 kg.

Switzerland is a long way from any areas where marine turtles can be found, but the Swiss Alps hide many fascinating and spectacular minerals...

ΚΟΡΓΙΑΛΕΝΕΙΟΣ ΒΙΒΛΙΟΘΗΚΗ

The Corgialenios Museum is situated on the ground level of the Corgialenios Library, in the heart of the Kefalonia's capital, Argostoli.

SMALL BUT MIGHTY

Discovering a historic jewellery collection at a small museum is always a welcome surprise. Here, globe-trotting *Gems&Jewellery* contributor, Helen Serras-Herman FGA, describes a recent tour of the Corgialenios Museum on the Greek island of Kefalonia.

The Corgialenios History & Folk Art Museum on the Greek island of Kefalonia offers a fascinating insight into the lives of residents in times gone by.

Every time my husband and I visit Greece, we visit the island of Kefalonia (also spelled Cephalonia). The island is located off the west coast of Greece in the Ionian Sea and is part of the group of the 'Seven Ionian Islands' known as the Heptanese. In contrast to the well-known Cyclades Islands in the Aegean Sea, with their stark desert-like natural beauty, white-washed houses and bright blue church domes, the Ionian Islands are very green, with beautiful idyllic beaches, soaring mountains reaching down to the sea, vineyards and olive groves.

The houses on Kefalonia are built in the neoclassical style with bright red tile roofs and baroque wrought-iron balcony railings, reflecting the centuries-long Venetian rule from 1194 to 1797, which



The museum is packed with an eclectic mix of exhibits and artefacts from everyday urban and rural life and special occasions.

was followed by British governance from 1809 until 1864. Under the Venetian rule, the islands never became part of the Ottoman Empire (as was the case with mainland Greece), and created a distinct cultural identity with many Italian influences still noticeable today in architecture, cuisine and a distinct melodic dialect.

The Corgialenios History & Folk Art Museum (also spelled Korgialenios) is located in the heart of the island's capital, Argostoli, very near the main Vallianou Square. Argostoli has been the capital and administrative center of the island since 1797. The town is built at the end of a peninsula that extends in the Argostoli Bay and stretches from the shores of the Koutavos Lagoon to the east, the waterfront and harbour, to the top of the hill that overlooks both sides of the peninsula.

The museum's aim is to preserve, conserve and disseminate the cultural heritage and traditions of Kefalonia and the Ionian Islands' civilization. The museum is rather small but packed with an eclectic mix of exhibits and artefacts from everyday urban and rural life and special occasions, period clothing and uniforms, household items, linen and lace-making, paintings and photographs and religious icons. There is also a small



Beautiful hand-carved mother-of-pearl ornaments, one of them being a cross unfortunately broken in two pieces, and another one is a ciborium.

display dedicated to the poet Lord Byron, with a painting from an old photo of the house where he lived in the village of Metaxata in Kefalonia for four months before leaving for Missolongi in 1823 to fight for the Greek War of Independence, where he later died in 1824. Most items in the museum are labeled both in Greek and English.

One case holds beautiful hand-carved mother-of-pearl ornaments, one of them being a cross, unfortunately broken in two pieces. Another one is a ciborium, which is a receptacle shaped like a shrine that is used in the Christian Church for the reservation of the Eucharistic bread. Inlaying mother-of-pearl was a traditional handicraft dating back to ancient Sumeria, Egypt and Greece. It later became part of the Ottoman art world with its famous geometric patterns; however, elaborate carvings became popular with the spread of religious Christian artefacts during the Renaissance in Europe. Franciscan monks went to Bethlehem in the Middle East around the 15th century and there started a tradition there of carving mother-of-pearl that continues to this day.

In another case, there are two gorgeous belt buckles from priests' robes. These elaborate belt ornaments, or clips, are known as *Porpe(s)* from the ancient Greek name, which is still used today in modern Greek language to mean an intricate belt buckle uniting two pieces together. The *porpe* was an important piece of jewellery for women's and men's clothing in Ancient Greece and Rome and later during the Byzantine Empire.

The more lavish the *porpe* was, the more it reflected elevated wealth and status. One *porpe* at the Corgialenios Museum is embroidered silk with gold thread and seed pearls, woven on a papier-mâché background and mounted on a silver frame. The other one is a gilded silver buckle for the robe of monk Daniel from the monastery of Docharian, dating back to 1773.

The museum is rather small but packed with an eclectic mix of exhibits and artefacts from everyday urban and rural life...

Among a group of gold pins there is a beautiful ivory carved brooch featuring the head of a young girl, set in gold with filigree open work and solid gold leaves and pearls, possibly of Italian origin. Filigree is the delicate, intricate lace-like ornamental metalwork made from gold or silver, popular from the 17th to the late 19th centuries. The fine wire

is twisted in order to form decorative motifs, often combinations of geometric patterns, rosettes, flowers, and more rarely figures or animals, especially birds.

Next to the belt buckles are three engraved seals, two of them are carnelian. What I also noticed, were a few men's pocket watches, two of them in gold, others in silver, dating from the early 19th century to the beginning of the 20th. →



Among a group of gold pins, there is a beautiful ivory carved brooch featuring the head of a young girl, set in gold with filigree work and solid gold leaves and pearls, possibly of Italian origin.



Men's pocket watches, two of them in gold, others in silver, dating from the early 19th century to the beginning of the 20th.



*Elaborate belt buckle ornaments from priests' robes known as *Porpe(s)* in embroidered silk with gold thread and seed pearls.*



A stunning silver gilded (gold over silver) filigree necklace and diadem set, made circa 1900 by silversmiths in Ionnina, in Epirus on the mainland Greece.

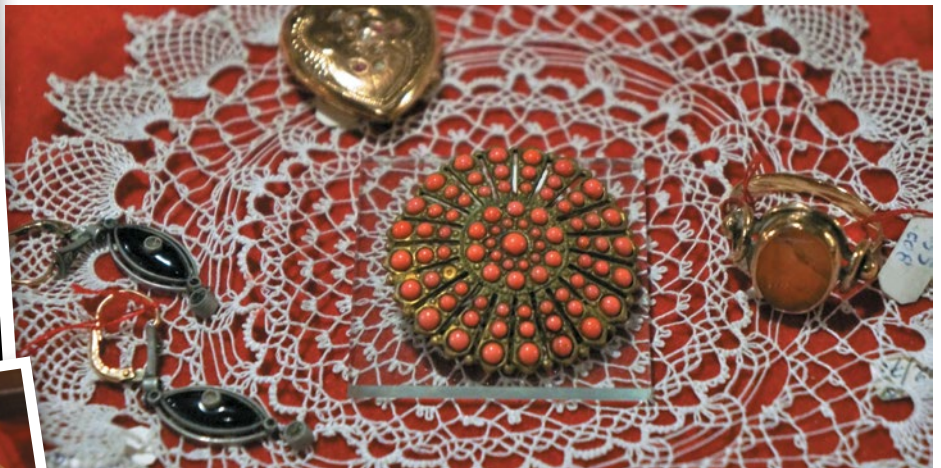


The silver gilded diadem, possibly a bridal ornament, made circa 1900.

One of the gold watches has the name 'Angelou Anninou' monogrammed on the leather sachet, displayed along with a men's gold ring in the Art Nouveau style. The reason I was drawn to these pocket watches was because I was reminded of a similar one that I have from my great-grandfather Paul Serras, who was born and raised on Kefalonia, acquired from his travels to Europe and France, with an engraving 'Grand Prix Paris 1900, Paolo Serras' inside the watch.

The pieces that truly caught my attention were a stunning silver gilded (gold over silver) necklace and diadem set, worn by Eugenia Typaldou Basia. The necklace is composed of filigree flower-shaped rosette elements in graduating size, linked together with two rows of chain. From the main flower ornaments hang two drop ornaments. The set was made circa 1900 by silversmiths in Ionnina, in Epirus on mainland Greece, one of the Greek centres of goldsmithing famous for creating earrings, belt buckles, necklaces and bridal diadems.

The last two pieces that I was truly drawn to were two beautiful gold brooches with coral. The first one is a rosette pin from the end of the 19th century set with red coral. The round cabochons are graduating in size. The



A rosette pin with red coral, displayed on a beautifully embroidered lace.

pin is displayed on a beautifully embroidered lace – one of the many exhibited in the museum – next to a pair of earrings made of black onyx set in white and yellow gold, a heart-shaped locket that includes a double pocket for photographs, and a gold ring set with a carnelian engraved seal, from the 19th century.

The second coral brooch is a striking, ornate piece, dating from the first half of the 19th century. It features small peach-orange coral pieces with motifs carved in the shape of grapes, leaves, pomegranates, acorns, and a centerpiece in the shape of a bull's head, set on the end of gold stems, all clustered together as a bouquet of nature's wealth. The pomegranate is an ancient symbol of Aphrodite and Persephone, expressing good wishes for rich fertility. The sacred bull's head is a symbol dating back to the Sumerian and Egyptian civilizations, taking centre stage in the Minoan civilization in ancient Crete, known as the 'Cretan Bull' or Minotaur.



This coral brooch is a striking, ornate piece, dating from the first half of the 19th century. It features small peach-orange coral pieces with motifs carved in the shape of grapes, leaves, pomegranates, acorns, and a centerpiece in the shape of a bull's head.

Since red coral is found in the waters of both Greece and Italy, it is a gem frequently encountered in historic Greek jewellery, often along with turquoise and pearls. The brooch measures 7 × 5.5 cm and belonged to Maria Kosmetatou, a member of another prominent Kefalonian family.

I can only imagine all these beautiful jewellery pieces being worn by the Kefalonian residents of a bygone era. They offer only a glimpse to a time when the island prospered, a period wiped out not only by time but by devastating natural disasters and earthquakes, often taking place on the island. My grandfather, Panagiotis Serras, abandoned the island after a harmful bug infestation left the vines in ruins, and moved to Athens in 1908, where my father was later born. Today, the island is flourishing again, but mostly due to tourism.

The Corgialenios History & Folk Art Museum is open daily 9am to 3pm, except Sundays. Peak summer times for the island are the months of July and August, although we have always enjoyed mild weather there in September.

The sun-kissed island of Kefalonia is also famous besides its natural beauty, for a number of geological phenomena, such as the subterranean Melissani Lake & Cave, the Drogarati Cave full of stalactites, and the sinkholes of Katavothres in Argostoli, all memorable attractions for nature-lovers and cultural travellers alike. ■



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PRECIOUS GEMS OF THE SILK ROUTES

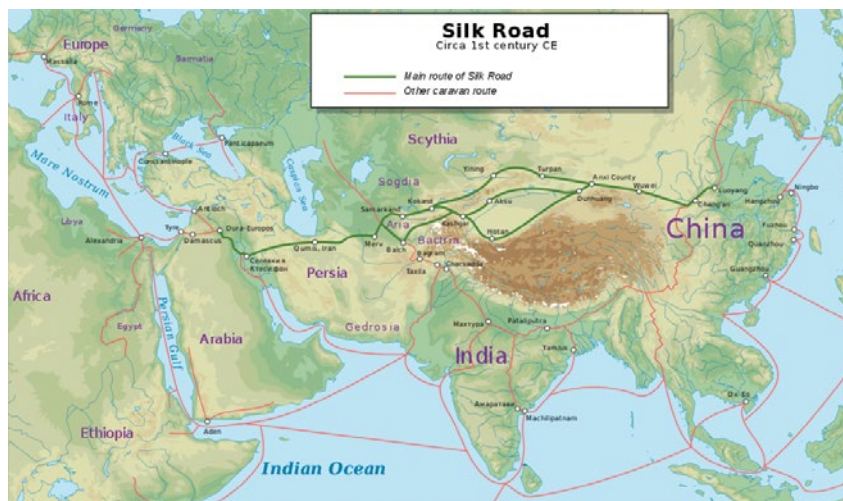
Inspired by her 20-year career in the gemstone and jewellery industries, Sandrine Martin GG explores the historic 'Silk Road' and considers its place in the fascinating timeline of gemstone trading between East and West.

Linking the east of China in X'ian to the West, the 'Silk Road' as we know it today came into existence during the Han dynasty when Emperor Wu (reign 140-87 BC), hoping to establish an alliance with the Yuezhi people living in the Ferghana region (today Uzbekistan) against their common enemy to the north, the nomadic tribes of the Xiongnu

based in modern day Mongolia, sent his imperial envoy Zhang Qian to Central Asia in 139 BC. The famous explorer and diplomat's accounts (circa 112 BC) are the first written testimony available.

Coined in 1877 by German geographer Baron Ferdinand von Richthofen, the term 'Silk Road' is very recent. While we can distinguish three main roads, two overland and one sea route, the 'Silk Road' is in fact composed of a myriad of hazardous trails linking China, as well as Japan and Korea, to India, Parthia and Rome. 'Silk Routes' therefore appears to be more relevant (1).

This article focuses on the most glorious era of the Silk Routes (approx. 200 BC to 1000 AD) (2). Such splendour could emerge thanks to the well-established and powerful Empires of the time; in the East, China during the Han and Tang dynasties and its neighbours the Kushan and later the Gupta Empire. Further west; the Roman world, followed by the Byzantine Empire. While a large amount of precious gems, including agate, Baltic amber, diamond, emerald,



1: A map of the main Silk Routes and other, additional routes taken by traders. Image Creative Commons-Wikimedia.org (Kaidor [CC BY-SA 4.0 creativecommons.org/licenses/by-sa/4.0]).

garnet, ivory and turquoise were traded, seven have been selected for their significant economic, cultural and artistic impact: lapis lazuli, jade, coral, pearl, sapphire, ruby and spinel.

LAPIS LAZULI

One of the earliest known traded gems, the 'sappir spotted with gold' was apparently traded from the mines of Badakhshan (modern Afghanistan) as early as the second half of the 4th millennium BC. Nestled in the centre of the Hindu-Kush Mountains, the mines of Sar-E-Sang are one of the oldest sources of lapis and have historically delivered the finest quality of this starry gem.

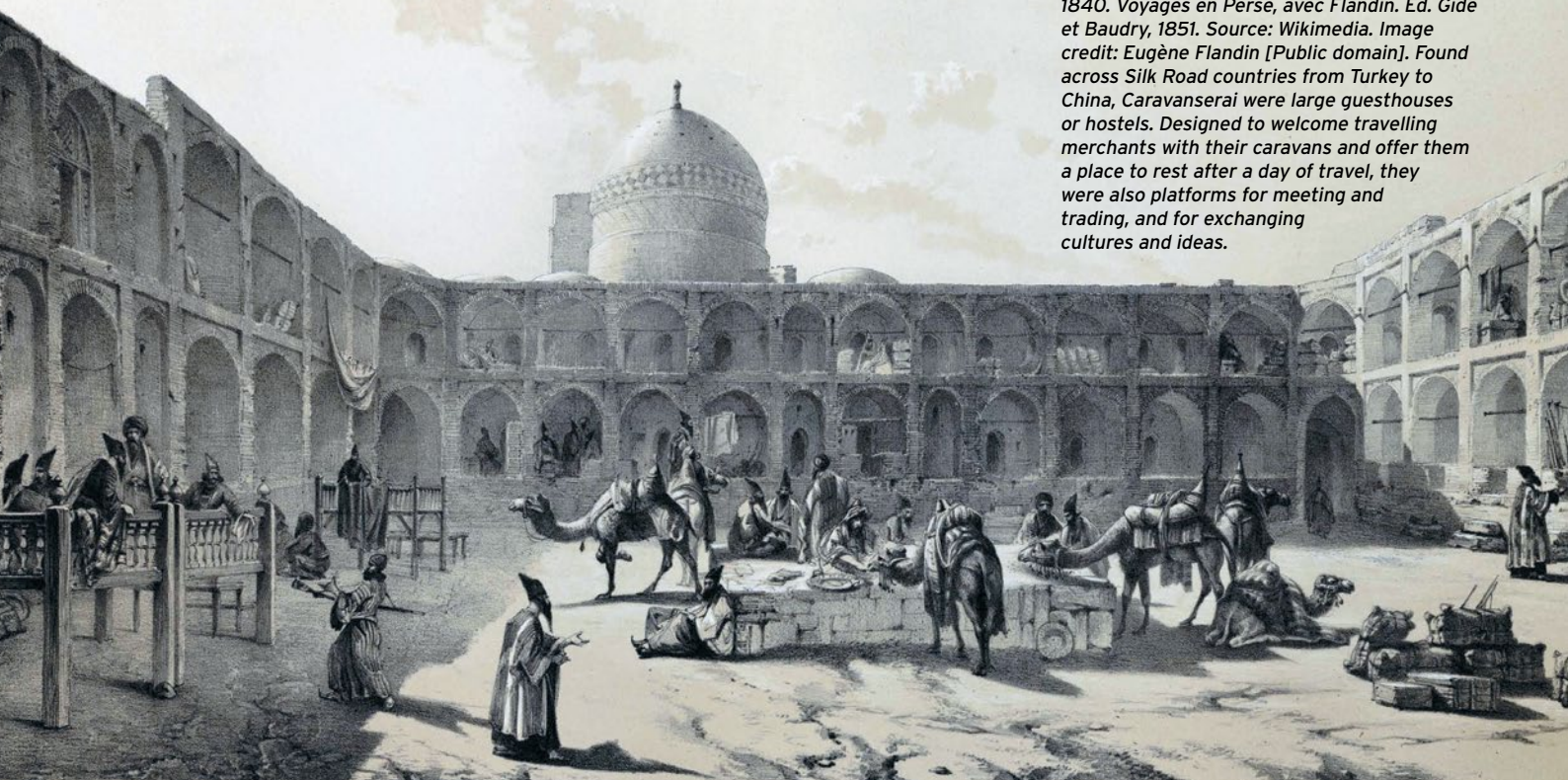
The earliest known use of lapis lazuli is in the form of

beads, found at Neolithic burials in Mehrgarh (7000-3200 BC) in the west of Indus Valley, Pakistan. Praised by ancient civilizations for its intense color, the use of lapis as a gem and as an object of ritual is supremely



3: Naqada I, Egyptian female figure circa 3700 BC, bone with lapis lazuli inlay (British Museum). Credit: Jon Bodsworth, Wikimedia Creative Commons.

4: Golden funeral mask of King Tutankhamun. Egypt Archive Cairo Museum. Credit: Jon Bodsworth, Wikimedia Creative Commons.



2: Caravanserai. Lithographie Eugène Flandin, 1840. *Voyages en Perse, avec Flandin*. Ed. Gide et Baudry, 1851. Source: Wikimedia. Image credit: Eugène Flandin [Public domain]. Found across Silk Road countries from Turkey to China, Caravanserai were large guesthouses or hostels. Designed to welcome travelling merchants with their caravans and offer them a place to rest after a day of travel, they were also platforms for meeting and trading, and for exchanging cultures and ideas.

unveiled by the treasures of the royal Sumerian tombs of Ur (2500 BC), within which were discovered statuettes, beads and delicate bowls, all made of lapis. Other civilizations as well, such as the Hebrews, the Babylonians, the Akadians and the Assyrians favored the azure gem for ornamentation in their jewellery and seals.

Embraced by the Ancient Egyptians as an ornament and amulet, lapis was associated with the wisdom of the 'all-seeing' Eye of Horus and was prized for its eye-opening qualities (3 & 4). It was ground and used as an eye wash, while Egyptian ladies used its vibrant-hue powder as an eyeshadow.

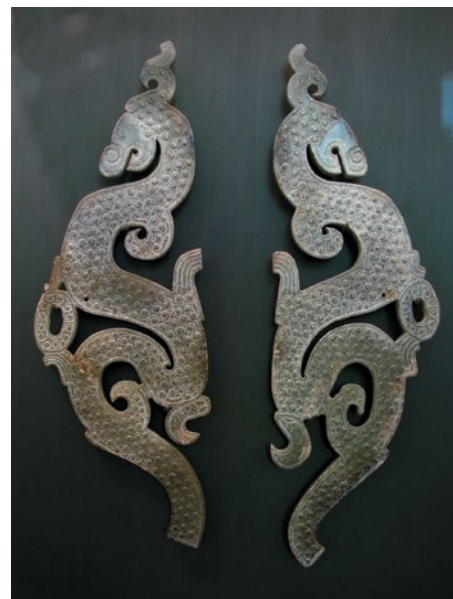
Introduced in Europe under the name ultramarinus – 'beyond the sea' – as early as the 5th century, the use of ground lapis as a pigment developed throughout the centuries. As exemplified by the 6th-century Sogdian and Buddhist frescoes, and the Byzantine churches of the 10th century, the ultramarine pigment was favoured by artists in their works (Colomban, 2005). Often reserved for religious images, lapis remained the most precious blue pigment throughout the Middle Ages and into the Renaissance, until the discovery of an artificial ultramarine substitute in 1826.

JADE

For millennia, Chinese culture has attributed jade with divine and imperial characteristics. A symbol of purity and moral integrity, prized for its durability and magical qualities, jade has seduced scholars and artists, and has for centuries been associated with the Son of Heaven (the sacred imperial title of the Chinese emperor). Jade was carved as early as the Neolithic period when it was used for sacrifice and ritual objects. The starting point of the three main Silk Roads – within the modern region of Xinjiang – was perhaps the main source of jade. Under the mid-Shang (ca. 1600-1050 BC) and the Zhou (ca. 1046-256 BC) dynasties, jade was uncovered in the rivers of Khotan (an ancient Iranian Saka Buddhist kingdom) and Yarkand (5). For thousands of years, the acknowledged source of nephrite for both Chinese and western Asian societies was Khotan (Keene, 2004).

The expansion of the Greek Empire was a major step in the history of the Silk Road. The conquest of India by Alexander the Great in 327-326 BC, followed by the establishment of the Indo-Greek rulers of Bactria in the Punjab and adjacent territories in 180 BC, left a deep imprint in the Indian territory.

Hence, a considerable volume of trade between India and the West came into existence. During the first century BC, the Greeks established in India imported silk and other articles from China, including jade, as demonstrated by jade objects dated from the Greek period excavated from the ancient Indian site of Taxila (Marshall, 1951). →



5: Jade Huang pendants. Han dynasty 2nd century BC. Musée Guimet Paris [Public domain]. Credit: Vassil, Wikimedia Creative Commons.



6: *Madonna and Child with Angels, Giovanni dal Ponte, Florence, 1410s, tempera and gold leaf on panel – Blanton Museum of Art – Austin, Texas. Credit: Daderot, Wikimedia Creative Commons [Public domain]. Note the coral necklace on the baby Jesus' neck.*

CORAL

Harvested from the coasts of Italy for centuries, the precious *Corallium Rubrum* (precious coral or red coral) has been an important Mediterranean resource since antiquity. At the turn of the Common Era (AD), the most significant of the overseas trade for the Roman Empire was with south India and the *Periplus of the Erythraean Sea* (an ancient manuscript that lists ports and coastal landmarks as a form of naval log) makes references of Greco-Roman merchants selling in Barbaricum (modern Karachi) "figured linens, topaz, coral, (...)."

Pliny the Elder observed that the red gem was highly treasured in India, just as pearls were in Rome, and that the great demand for Mediterranean coral, especially among Indians, had made its uses in its region of origin quite rare. Aside from jewellery use, the affection for coral also came from its spiritual associations. According to Vedic astrology (Hindu astrology), coral symbolises life and blood force, and is ruled by the planet Mars. The Mediterranean gem is also one of the seven treasures in Buddhism.

Precious coral travelled as far east as Japan: it is said that the crown worn at the consecration of the Great Buddha of Todaiji Temple by Emperor Shomu and Empress Komyo in 756 AD, was inlaid with 10 hanging beads of red coral from the Mediterranean Sea.

PEARLS

Moving in opposite directions, coral and pearls played a leading role in the 'Indo-Sino-Mediterranean' trade of the time. "It is the Indian Ocean that principally sends them to us. The most productive of pearls is the island of Taprobane (...) But those which are most highly valued are found in the vicinity of Arabia, in the Persian Gulf", reports Pliny the Elder. Celebrated in the Greco-Roman world since classical time, 'margarites', the first specific word for pearl, was introduced by Theophrastus (ca. 372 – ca. 287 BC), successor to Aristotle in the Peripatetic school of philosophy in Ancient Greece. In Ancient Rome, 'unio' was a more common name as Pliny the Elder explained that each pearl was unique. Valued for their singularity and for their brilliance, owning a pearl was a great luxury amongst the Roman elite (7 & 8).

The balance of the trade between Rome and India was very much in favour of India, to such a degree that Roman conservatives would deplore the insatiable appetite of Roman society for oriental



7: *'The catching of pearls'. Bern Physiologus, 9th century, diving for natural pearls. Source: Wikimedia Creative Commons.*

luxuries, including pearls, being (according to them) destructive of civic values and depleting the wealth of the Empire.

Equally rewarding for India was the mercantile activity with China. The Celestial Empire has a long history of using the 'Queen of Gems'. During the Han dynasty, the Chinese region of Jiaozhi (modern Liangguang and northern Vietnam) acted as a crucial link in the maritime trading system with the Western world.

8: *Pair of gold earrings with pearls and sapphires. Byzantine, 6th-7th century. Image courtesy of Metropolitan Museum of Art, New York.*



Ancient Chinese texts provide a glimpse of the wealth traded in Jiaozhi, including pearls. The Han Wei Congshu reads that during the Han, men of the Annamese coast rode elephants into the sea to find and bring back the treasures from the deep, in particular the beautiful pearls (Schafer, 1985).

SAPPHIRES

One of the oldest sources of gemstones, Sri Lanka was most probably the original source for sapphires and rubies. According to ancient Indian works on gemmology, gems are classified as Maharatna 'precious' and Uparatna 'semi-precious' stones. Diamond, pearl, ruby, emerald and sapphire are identified as 'precious'. The Chitrastotra (ca. 5th AD), the Indian text that discusses 'The Art of Painting', says: "A king should be drawn just as a god. The handsome looking King (...) wears a tiara of floral motif from which hang string of pearls and sapphire."



9: *An intaglio of a Ptolemaic dynasty princess wearing a diadem. Ceylon sapphire, 2nd century BC. Cabinet des Médailles, Paris. Credit: Marie-Lan Nguyen, Wikimedia Commons.*



10: Map of Ceylon (Taprobane) Alain Mallet, 1686. Credit: Geographicus Rare Antique Maps (geographicus.com/mm5/cartographers/mallet.txt) [Public domain].

At the beginning of the Common Era, sapphire was, with natural pearl, one of the most important items exported from Sri Lanka to the Western world (9). During the reign of Emperor Claudius (41 to 54 AD), Pliny wrote about ambassadors visiting Taprobane (the Ancient Greek name for Sri Lanka), mentioning its quantity and variety of precious stones (10). The wealth of Sri Lanka was equally praised by the Chinese and Yi Jin, the 7th century Buddhist monk and traveller, named it 'Baozhu', literally 'Jewel Isle' (Kakakuso, 1896).

RUBIES

The belief in India that offerings to the gods will bring prosperity and happiness is revealed in many ancient and modern Hindu writings. The Hâiti Smriti reads: "Coral in worship will subdue all the three worlds. He who worships Krishna with rubies will be reborn as a powerful emperor, if with a small ruby, he will be born a king. (...)" (Kunz, 1971). Called ratnaraj in Sanskrit, rubies were considered a symbol of permanent, eternal fire. References to fire were also commonplace in Greco-Roman times.

For the period of our interest (approx. 200 BC to 1,000 AD), available literature mostly connects rubies with Ceylon (Sri Lanka). In his sixth-century

'Christian Topography', Cosmas Indicopleustes, the Byzantine merchant, traveller and later monk, who made several voyages to India and Ceylon writes: "In this island they have many temples, and on one, (...) there is a ruby as large as a great pine-cone, fiery red, and when seen flashing from a distance, especially if the sun's rays are playing round it, a matchless sight." He continues: "The island being, as it is, in a central position, is much frequented by ships from all parts of India and from Persia and Ethiopia, and it likewise sends out many of its own."

Unearthed in October 1970 at Hejiacun village in the southern suburbs of Xi'an (where the Xinghua Workshop of the ancient capital Chang'an — meaning 'Perpetual Place' had been located during the Tang dynasty) during the Tang Dynasty had been located) the Hejiacun hoard attests to the use of rubies and sapphires in China during the Tang. Over 220 silver and gold objects, silver ingots, drinking vessels and belts made from glass, rock crystal and jade, as well as rubies, sapphires and amber were discovered.

SPINELS

Afghanistan is not only the land of the precious lapis lazuli, it is also home to the mythical red spinels of Kuh-i-Lal. Located in a remote valley in Tajikistan, it is said that the traditional historic source of spinels was discovered in the 7th century, after an earthquake had unearthed some of the precious red stones. Named 'balas rubies', it took centuries for the Afghan jewel to unveil its true identity, and it was not until 1783 that spinel was identified as a different mineral to the red corundum.

Meanwhile, the red to pinkish red gem was coveted by the rulers of ancient Timur and later by the Mughal emperors (11). Throughout history, exceptional spinels from Kuh-i-Lal have adorned kings and emperors, such as the Timur Ruby, an exceptional spinel of over 350 carats that was in the possession of the Mughal Emperor Jahangir and is now in the private collection of HM Queen Elizabeth II, and the legendary Black Prince's Ruby (about 177 carats), which is set in the front of the Imperial State Crown, part of the Crown Jewels of the United Kingdom.



11: Imperial Mughal spinel necklace, displaying 11 polished spinels. Three of the gems are engraved: two with the name of Emperor Jahangir, one with the three names of Emperor Jahangir, Emperor Shah Jahan and Emperor Alamgir, also known as Aurangzeb. Photo credit © Denis Hayoun, Art Photo Diode SA. Image courtesy of Christie's.

CONCLUSION

With its caravans transporting mysterious treasures from China across the Eurasian steppe to Arabia and the Western world, the 'Silk Routes' continue to spark the imaginations of many. For centuries, the dynamic of these legendary routes not only facilitated the transmission of migrants and merchandise, it also expanded cultures, ideas, religions, technologies and arts, allowing them to spread and interconnect, thus shaping civilizations in Europe, Arabia, Persia, India, and China. Precious gems have played a significant role in this diffusion: as we have seen, the vibrant trade of gems did not only move and inspire merchants, but also skilled workers, artisans and artists (12). ■

An unabridged version of this article and a full list of references, are available upon request.



12: Inspiring artists across the globe. Consider Johannes Vermeer's masterpiece: Girl with a Pearl Earring. Credit: Mauritshuis Museum, Wikimedia Public Domain.

OPSY 123456

Identifying Marks

When British-based company Opsydia established to “disrupt a number of industries by its ability to create practically invisible structures inside transparent materials,” the implications for diamond security and identification were a tantalising route to market. Here, chief executive officer, Andrew Rimmer, speaks to *Gems&Jewellery* about the company’s impressive laser technology...

Back in 2017, Professor Martin Booth and Doctor Patrick Salter of the University of Oxford used their expertise in engineering science to develop a new technology using high-precision lasers. This technology has implications across many sectors, but its ability to make microscopic marks inside diamonds was quickly identified and considered a commercially relevant pursuit. Using its well-proven methods of commercialising the inventions of its research specialists, the University of Oxford created Opsydia — a company

that utilises the work of Prof. Booth and Dr. Salter and has found a niche in diamond security and traceability.

So, what does Opsydia technology do? In simplified terms, using a very high precision and high-speed laser, Opsydia has the ability to create highly configurable, tiny marks beneath the surface of a diamond that are just thousandths of millimetres wide. These marks are not visible to the jeweller’s loupe, do not affect the surface or clarity of a diamond, and can be personalised to inscribe a number, logo, coded mark or even a QR

code. On the other hand, marks can be made big enough to be detectable with a loupe, whether that’s a brand logo or a jeweller’s identifying mark.

Opsydia’s technology is set apart because of the way it can control a single laser beam as it passes through a diamond’s surface. When the laser passes through the surface of a diamond it is out of focus, only coming into focus below the surface. This has the effect of bypassing a diamond’s surface and only marking a microscopic area within the material itself. Opsydia chief executive officer, Andrew Rimmer, explains: “People have asked if we are drilling a hole through the surface, and the answer is no, not at all. The diamond surface is totally intact with its original polish. We can create incredibly small marks, which don’t affect the clarity of a diamond and are not detectable by the jeweller’s loupe.”

The implications for diamond security and traceability are exciting. “We can’t state it can’t be removed,” Rimmer says, “but if you think [the mark] is about a fifth to a quarter of a millimetre below the surface of a facet, to remove it you’ve got to take this off that facet



The Opsydia team, including CEO Andrew Rimmer (centre).

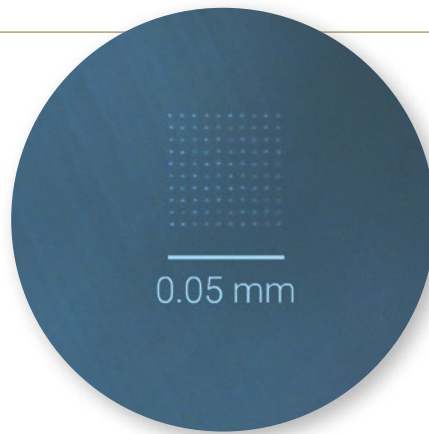
and therefore the rest of the facets of a stone. It is uneconomical to remove because you would lose so much of the stone to do so."

In contrast to surface marks, Opsydia technology offers something far more permanent and less likely to be removed. "We are really locking in the identity of a stone," Rimmer says. "What does the end user want? They want to be confident of a stone's origin, confident of the grading certificate and confident that the stone in front of them is really the stone that matches with that certificate. As we know, there are problems within the industry where effectively counterfeit stones, or poorer quality stones, are appearing on the market [with a] fake grading certificate."

Opsydia can mark a diamond with its exact grading report number or inscribe a diamond with an encrypted number or coded mark that connects to a blockchain. When discussing the benefits of Opsydia technology in the context of blockchain ledgers, Rimmer says: "What we are doing is making a secure link between the physical item, the diamond, and what is in the ledger. You've got this super-secure way of storing information, but you can't guarantee that the actual stone in front of you on the bench is the same one on the ledger – this is the crucial bit where we think we can play a part."

A second layer of security arrives in the composition of the mark itself. Brands and businesses only have access to marks authorised by Opsydia that are pre-encrypted into their device. What this means is that marks can't be introduced at a moment's notice, altered or swapped between different devices — only Opsydia has the power to do this. "If you are a customer and you've got your logo and that is encrypted and put into your machine that we have provided to you, then we will make sure your logo can't be written in a stone by another Opsydia machine, unless it is one of your partners and you give us permission," Rimmer explains. "We are not just providing a marking solution; we are actually providing a security solution as part of that."

Physically, the Opsydia device is around one metre wide, approximately shoulder height and was purposefully designed to fit through a standard doorway. It is perhaps better suited to large-scale environments at this early stage in its development, however, as



A small dot array inside a diamond under high magnification, with scale bar for reference.

with 3D printers, technology has a habit of scaling down over time. Depending upon the complexity of the mark, Opsydia approximates a time of one minute per stone, with the possibility to mark between 50,000 and 100,000 stones per year if run on a two-shift system. Rimmer adds: "It is designed as a high capacity machine and to handle quite big volumes."

Although the machine can mark melee-sized diamonds, this may not be a commercially viable pursuit for a business dealing in large volumes. Instead, Rimmer believes the device will find more use among those marking diamonds of 0.2 carats and above. Test devices allow for multiple stones (around 25) to be loaded at once in a cassette, while others may choose to load one stone at a time to avoid misidentification. These elements of the Opsydia device have all been introduced to make it as practical and user-friendly as possible for the end customer.

For jewellers, an added advantage of the technology is that it can introduce microscopic/loupe-visible marks in parts of a diamond that can be easily viewed when set, such as the crown or table. One jewellery brand that is already

capitalising on Opsydia technology is De Beers' laboratory-grown diamond experiment, Lightbox. Rather than opting for a microscopic mark, Lightbox has purposefully chosen a "big" loupe-visible brand mark (around one third of a millimetre in height) inscribed right in the middle of the table. This makes it even more unlikely that anyone could pass off a Lightbox lab-grown diamond as a natural stone.

To get its message out there, Opsydia has begun to tackle the international trade show scene, including JCK Las Vegas earlier this year. Interest has come from both the laboratory-grown diamond sector and the natural diamond sector. Rimmer says: "Its got two quite different applications: on natural stones it offers an incredibly small, secure mark that doesn't effect clarity, and for laboratory grown diamonds, the potential to have a secure means of identifying the fact a stone is lab-grown and [those producing them are] operating responsibly."

Although the core application is with diamonds, Rimmer explains that "heavily translucent" gemstones can also be marked. Tests have been conducted on emerald and ruby, with the implication that sapphires could also benefit in the future.

Opsydia may be a new player in the market, but this technology could empower businesses to act more responsibly in a consumer market that is crying out for ethical actions. Perhaps we will one day see numerous Opsydia devices at mine sites, right at source, inscribing rough diamonds with irrefutable marks right at the start of their journey. This step towards security and traceability will no doubt pique the interest of businesses at all levels of the supply chain. ■



The Opsydia Prototype Diamond Marking Machine.

All images courtesy of Opsydia.

A YEAR IN PICTURES

We were overwhelmed by the high standard of entries for this year's Gem-A Photographer of the Year Competition. Here, we outline the winning photograph, our runners up and the exceptional shortlist...

The Gem-A Photographer of the Year Competition 2019 came to a close on September 16 when Evgenios Petrides FGA GG was named the overall winner for his incredible photomicrograph. Titled 'Microchip,' the photograph of an iron oxide inclusion in a Brazilian quartz specimen bears an uncanny resemblance to a computer component. This year's top prize includes a £300 Gem-A Instruments voucher, along with one year's free membership of Gem-A.

Petrides says: "It is a great honour to have won the Gem-A Photographer of the Year Competition 2019! I feel

especially humbled since my photomicrograph was up against so many distinguished finalists with their magnificent photographs."

This year, Gem-A opted to forgo categories and open the annual competition up to non-members for the very first time. We were inundated with incredible photographs from across the world and were overwhelmed by the variety and high calibre of entries that landed in our inbox. In another twist, this year's winner and two runners up were chosen via an online poll. After a very tough shortlisting process, just 15 images were shortlisted and displayed as a gallery on the Gem-A Facebook page for one week. At the deadline, the entry with the highest total number of likes was named the winner, and the two entries with the second and third highest number of likes were named runners up.

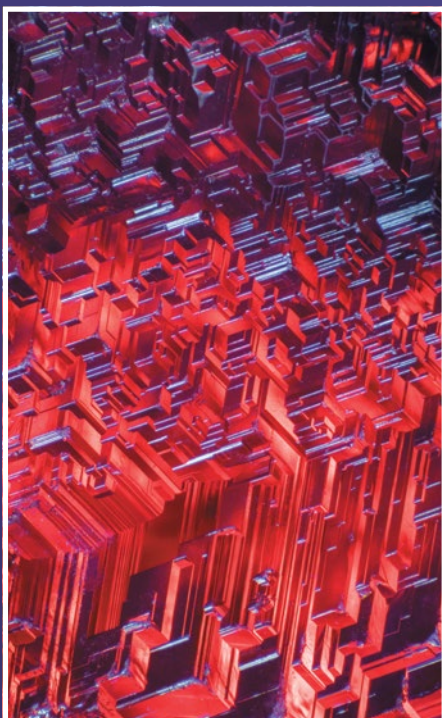


WINNER

Evgenios Petrides FGA GG – Microchip

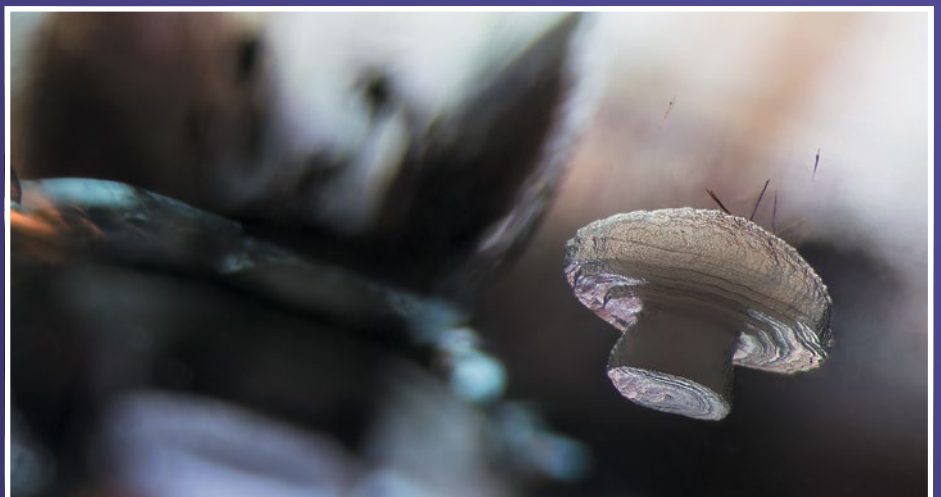
Our 2019 runners up, and winners of a £50 Gem-A Instruments voucher, are Melissa Allen FGA GG for 'Crimson Geoscape', a photomicrograph of the surface of an etched rough spessartine garnet crystal, and Billie Hughes for her incredible photomicrograph, 'Floating Mushroom', which reveals a mushroom-shaped cristobalite inclusion floating with an amethyst. Both of these images will feature in upcoming issues of *Gems&Jewellery*.

We would like to thank all of this year's entrants for their fantastic submissions! The Gem-A Photographer of the Year Competition will return for 2020. Keep an eye on the Gem-A Blog, our social media channels and, of course, *Gems&Jewellery* for updates. ■



RUNNER UP

Melissa Allen FGA GG – Crimson Geoscape



RUNNER UP

Billie Hughes – Floating Mushroom

The 2019 Shortlist



Tom Stephan MSc FGG EG – Rutile sunrise



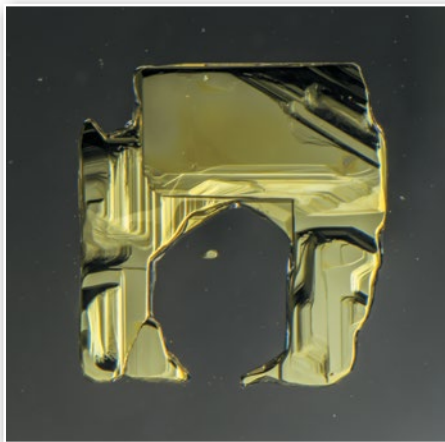
Susanne Pirsig – Negative crystal in blue sapphire – “BBS - Bigger Blue Splash”



Nicolas Hebert –
A ruby a day keeps problems away



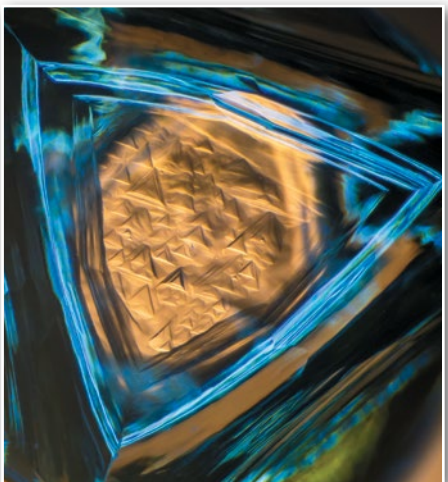
Wim Vertriest FGA GG – A hard day's work



Nathan Renfro FGA GG –
Pyrite arch in quartz 7.20 mm



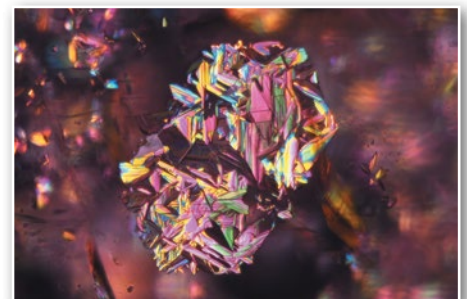
Abbie Haslett – Tourmaline dream



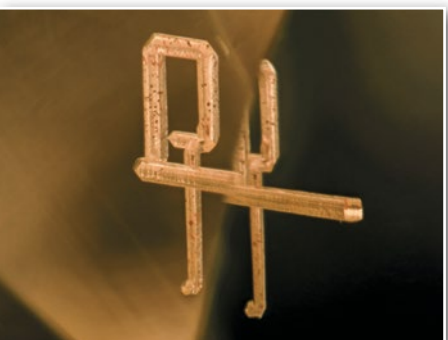
Melissa Allen FGA GG – Show me the trigons



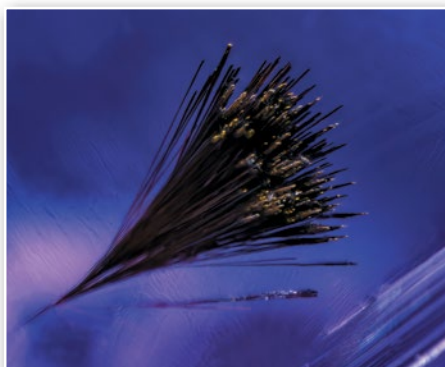
Danny Sanchez GG – Play of
colour in opal from Jalisco, Mexico



Charuwan Khowpong –
Iridescent intergrown blades of rutile
in Sri Lankan spinel



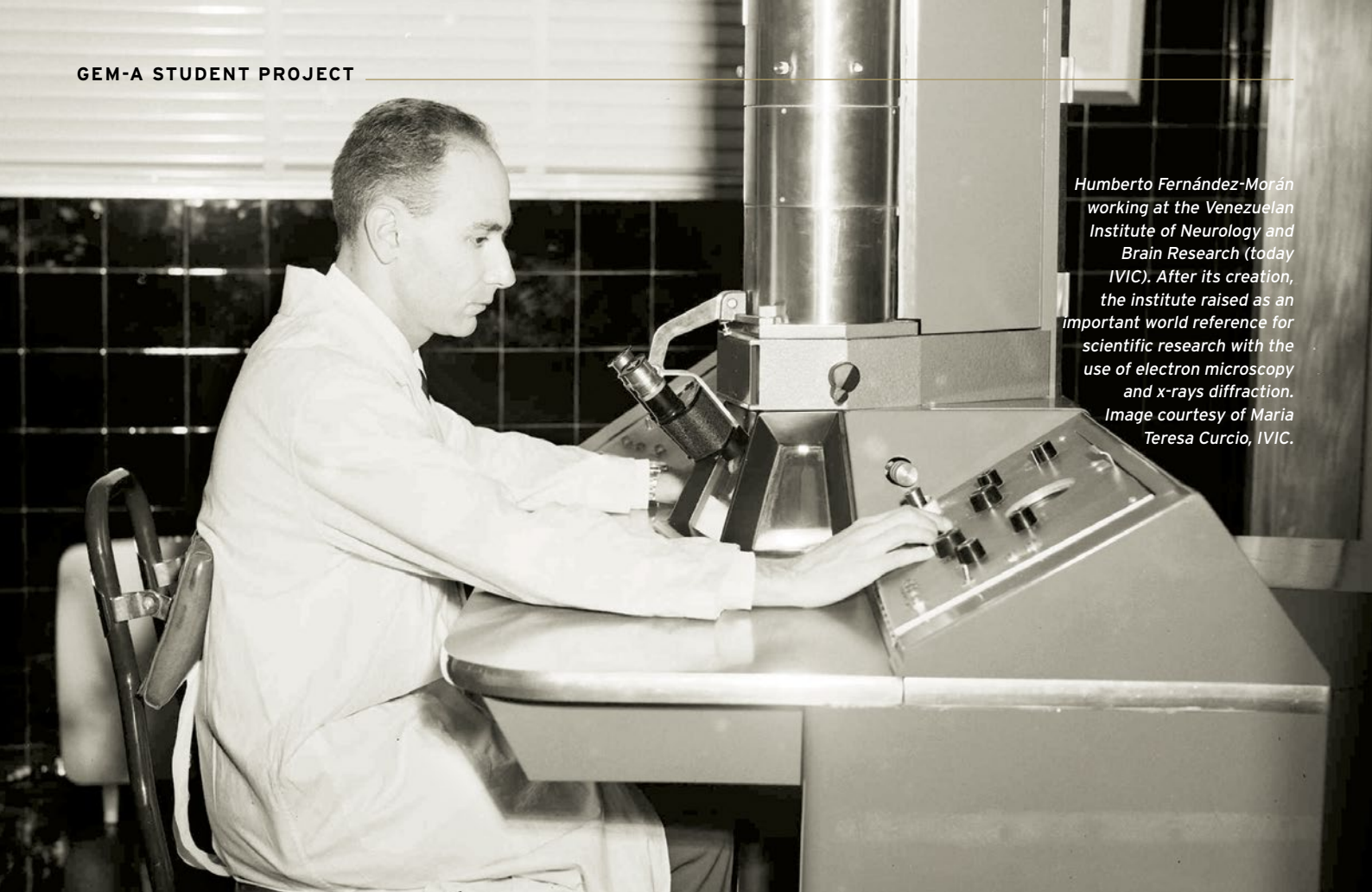
Forozan Zandi MSc –
Cancan Dancer in Diamond



Hasan Abdulla – A flower of goethite
needles inside a Brazilian amethyst



Wim Vertriest FGA GG –
A Young mother selling rough jade
at the Mandalay morning jade market



Humberto Fernández-Morán working at the Venezuelan Institute of Neurology and Brain Research (today IVIC). After its creation, the institute raised as an important world reference for scientific research with the use of electron microscopy and x-rays diffraction. Image courtesy of Maria Teresa Curcio, IVIC.

An Eye on Diamonds

Saúl Castro Gómez shares an abridged version of his Gem-A Diamond Diploma project from late 2017, which considers the way diamonds are utilised for ophthalmic surgery.

In 2017, Joachim Frank, Jacques Dubochet and Richard Henderson were awarded the Nobel Prize in Chemistry for “developing cryo-electron microscopy (Cryo-EM) for the high-resolution structure determination of biomolecules in solution”.

Cryo-EM is a technique of scientific observation consisting of the methodological freezing of biological specimens for further analysis by means of the high-resolution TEM (Transmission Electron Microscope). What is probably less well known is that among the many scientists that contributed in one way or another with this outcome, one that would play an important role was the late Venezuelan MD Humberto Fernández-Morán. In fact, his work was the precursor to the concept of Cryo-EM and he built the first cryo-electron microscope with superconducting lenses at liquid

helium temperatures in 1963 and 1966 respectively (Mendoza & Padrón, 2018).

With this starting point of resolution around 80 Å (now considered poor resolution) the road was paved so that in subsequent years experiments were able to reach and cross a resolution of 2 Å – a breakthrough in imaging technology – and one of the key aspects for which the trio of laureates in 2017 obtained the Nobel Prize in Chemistry. This is also known as the ‘Revolution of the Resolution’.

The events that surrounded the professional path of Dr. Fernández-Morán are considered both curiously successful and at times a myth. However, for the development of this Diamond Diploma project, journalistic inquiries were made into appropriate institutional and academic sources pertaining to his involvement in the field of science. Presumably from 1946, while working at

the neurosurgical unit at the Seraphim Hospital in Stockholm, Fernández-Morán developed an acute interest in the study of suitable materials for precision cutting and observation; the creation of a tool with better precision than those using soft metal blades had become a necessity. According to one account, “it was needed [for] the preparations of satisfactory sections in the range of 0.01 µm, requiring knives of exceptional characteristics” (Hawkes, P; 1985).

With this in mind, between 1954 and 1955, Fernández-Morán presented formally the concept of a diamond knife titled: “Improvements in or relating to a method of Polishing a Cutting Edge of a Diamond of a Cutting Tool.” This was the first patent given to Fernández-Morán, among others that followed, which relate to use of natural diamond in research. It was an important milestone that

Nowadays, the variety of instrumentation with diamond blades, having evolved from the work of Fernández-Morán, is significant.

enhanced the perception of diamonds as having scientific purpose, over and above its use as a gem material or in industry.

As stated by Fernández-Morán, when referring to his invention: "Practically, all kinds of solid material may be cut, no matter whether they are crystalline or amorphous, metallic or organic."

His work coincided with a time when appreciating the commercial value of diamonds in a comprehensive way was becoming more vital. In the 1950s, for example, GIA issued its first diamond grading report (King M John et al; 2008). Also, in this decade attempts were successfully made to replicate the physical and chemical properties of a natural diamond in a laboratory.

In the context of medicine, advances in diamond cutting equipment not only improved observations, but also research in medical histology, as these were carried out at that time with customary microtomes (a tool using metallic blades only).

In the field of ophthalmology, the use of a diamond scalpel has proved to be particularly useful. Nowadays, the variety of instrumentation with diamond blades, having evolved from the work of Fernández-Morán, is significant.

UNDERSTANDING REFRACTION: THE HUMAN EYE AND DIAMOND

In gemmology, refraction is a concept of utmost importance and this is understood as the change in the direction in which light travels when it passes from one medium into one of different optical density. Therefore, refraction plays a noteworthy function

in the identification of gemstones. On the other hand, in the ophthalmological field, it is possible to say that well-known vision deficiencies such as myopia, astigmatism and cataract, mentioning only a few, are all 'refractive errors' of the human eye.

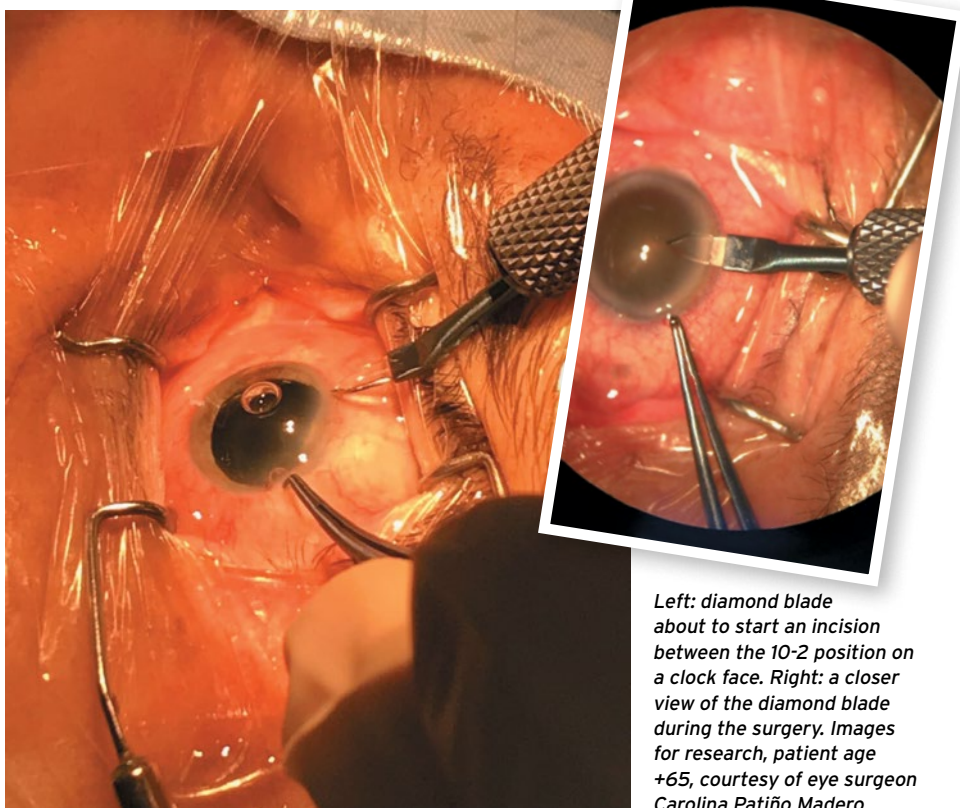
This raises three points of consideration: the first is related to the functionality of the eye and how it works; secondly, what is the best type of medical procedure to correct such errors of the human eye; and thirdly, what analogies or links can be drawn between gemmology and ophthalmology, considering diamond and refraction play such a big role in both fields.

Among the medical procedures available, a common one is cataract surgery, which is designed to remove the part of the eye known as the crystalline or natural lens, when, for a variety of causes such as disproportionate exposure to sunlight, diabetes, ageing and smoking, among others, it has become opaque. Looking very briefly at the history of cataract surgery, it is considered among the oldest medical procedures known to-date. According to a report by the American Academy of Ophthalmology (AAO) it may stretch back to times BCE. The first reported surgical removal of a cataract was in 1748 (Bellan, L; 1998).

CATARACT SURGERY: THE QUEST FOR AN INCISION

With regards to the current status of cataract surgery, it has been said that "from the beginning, the central spotlight was and always has been on the creation of the corneal tunnel" (Charles H. Williamson; 2007). The goal of the first cataract surgery was the complete removal of the lens/crystalline using a metal scalpel. The incision was made in the cornea scleral limbus, which is the junction between the cornea (transparent section) and the sclera (white section) of the eye. It was described as intracapsular (involving removal of the entire lens and its capsule), but the procedure did not solve the problem of vision. The patient was then rehabilitated with powerful glasses or contact lenses. In some parts of the world this surgery is still practised.

As the surgery progressed, extracapsular cataract extraction (involving removal of the front part of the capsule and the central part of the lens) began with intraocular lens placement, also simply known as IOL. This is carried out with the same cornea scleral incision, which is located in the upper part (between, the imaginary clock dials of 10 and 2) and the cataract is removed,



Left: diamond blade about to start an incision between the 10-2 position on a clock face. Right: a closer view of the diamond blade during the surgery. Images for research, patient age +65, courtesy of eye surgeon Carolina Patiño Madero.

leaving only the posterior capsule (which is the most posterior part of the crystalline) as a support to place an intraocular lens or IOL. The wound is closed with stitches.

Finally, phacoemulsification was reached, where through a port of entry in mm it is possible to introduce a phacoemulsifier, which is a very small hand piece. By means of ultrasonic vibrations, the diseased lens is reduced to a liquid and drained out of the eye, leaving only the posterior capsule. This remains as a support for a special lens that comes folded in an injector, allowing its introduction into the eye.

The application of diamond is a key element to this procedure, as the edge of the scalpel can make the main incisions where the handpiece is inserted. Diamond blades are also used for other auxiliary incisions for the injection of saline and viscoelastic, which are elements of support in the surgery. It is necessary to bear in mind that with the two previously mentioned procedures, intra/extra capsular surgeries, the incision is made in the junction between the cornea and the sclera – the limbus



Humberto Fernández-Morán during scientific observation. Magnification is also a key aspect of gemmology. Image courtesy of María Teresa Curcio, IVIC.

– while in the latter case, the idea is to create with the diamond edge a small incision in the cornea – a corneal tunnel – without altering the cornea curvature.

Diamond allows for the possibility of a precise cut without the risk of altering other structures during its movement through the cornea, which, despite being just 520 µm, in its central part is composed of 10 layers (among which are



Saúl Castro Gómez collects his Gem-A Diamond Diploma from jewellery historian John Benjamin at the Gem-A Graduation Ceremony 2018.

endotelio, epitelio and Bowman).

Experienced eye surgeon, Carolina Patiño Madero, offered her insights to support this Diamond Diploma project. She explains that all the cornea's layers are crossed with a diamond blade with such perfection that it does not alter them in any anatomically important way, as well as allowing for an incision that is self-sealing. In addition, complications such as detachment of the Descemet membrane due to trauma are prevented, avoiding the significant alteration of the transparency of the media (cornea, crystalline and vitreous body).

As a result of this, important benefits are achieved: during the surgery, the surgeon is afforded more accuracy and control, and for the patient the wound heals better as the incision is hermetically sealed, lowering the risk of endophthalmitis (inflammation), for example. Even as tech-based surgical procedures become more sophisticated, the use of diamond continues to play a key role in the context of eye surgery.

CONCLUSION

Via the Gemmological Association of Great Britain, future gemmologists are introduced to the function of the 'cone cells in the retina,' the concept of human trichromatic vision, and the methodology of observation with $\times 10$

loupe or gemmological microscope. It is certainly true that the power of our eyes, of vision, plays a vital role in the study of gemmology. Ours is an industry characterised by a large amount of capital, therefore, aspects such as colour grading should only be entrusted to knowledgeable gemmologists, those who display a high sense of integrity and with a good understanding of how human vision works, for it is vital in the subjective nature of colour appreciation.

As the old saying goes, 'Diamonds are a Girl's Best Friend'; the truth is, in the context of human vision, this does appear to apply. Cataracts remain the leading cause of blindness worldwide, affecting, for one reason or another, mostly women.

ACKNOWLEDGMENTS

For their valuable academic insights, the author would like to acknowledge scientific journalist María Teresa Curcio, Carolina Patiño MD, Martin Cevert MS, Valentina Molon FGA DGA, Raúl Padrón PhD, foreign associate of the National Academy of Sciences and Alessandro Borruso, deputy director of Sotheby's Diamonds Europe. ■

An unabridged version of this project and a full list of references are available upon request.

A DIAMOND OFFENSIVE

The Diamond Producers Association has hit back at the accusations levelled at the diamond industry with a third-party report, *Total Clarity*, which seeks to put the impact of diamond mining in context. If your customers are asking questions, here are some facts and stats to mention...

You could say that diamonds have needed a publicist in recent years. With the accusations thrown at diamond miners and the bold claims of laboratory-grown diamond manufacturers, it's hardly surprising that consumers are feeling confused.

To try and remedy this (and rescue the reputation of mined diamonds), the Diamond Producers Association (DPA), whose members represent 75% of the world's diamond production, commissioned an independent third-party Trucost, part of S&P Global, to analyse every inch of the diamond sector and measure its impact on people and planet. The final report, titled *Total Clarity*, took two years to produce meaning much of the data it analyses is from 2016. Despite this, the results are eye-opening.

The cynics among you will question the obvious: can this really be an unbiased report if it was commissioned by the DPA? The Association would argue, yes, because it features both positives, negatives and areas for improvement, such as reducing CO₂ emissions. Where the report is especially useful is in its like-for-like comparisons with other industries. The report cleverly highlights how a moral objection to diamond mining should by comparison lead to a moral objection to plenty of everyday items, like mobile phones.

For example, one of the most publicised aspects of the *Total Clarity* report is the environmental impact of

diamond mining. The report suggests that DPA members collectively emit 160 kg of CO₂ per polished carat produced, which is comparable to purchasing and using 2.5 smartphones and 5.5 bouquets of flowers. In contrast, the report argues that laboratory-grown diamond producers produce three times more greenhouse gases per polished carat (511 kg). Exactly how Trucost arrived at these figures is not outlined. The DPA report admits that its members could be fighting harder to secure renewable energy sources for its operations, although arguably the same could be said for laboratory-grown manufacturers.

Of course, environmental impact should also be measured in land displacement, habitat damage, water use and many other factors. DPA member mining operations use a combined area of 325 square miles (about the size of New York City), but collectively members protect three times the amount of land in conservation projects across Australia, Botswana, Canada, Russia, South Africa and Tanzania.

Total Clarity also seeks to address the diamond industry's relationship with its workers. As one vocal laboratory-grown diamond brand says on its website: "[It is] time for diamonds and stones to be sourced responsibly and have a more positive impact." But what does 'positive impact' actually mean? According to the Trucost report, DPA members employ



Diamond Producers Association CEO Jean-Marc Lieberherr with Livia Firth, co-founder and creative director of Eco-Age. Image credit: Eco-Age.

some 77,000 people who are paid 66% more than their country's national average salary on average. It also claims that US\$6.8 billion is infused into local communities through the purchase of local goods and services as a result of DPA member activities.

Speaking at a recent event, Jean-Marc Lieberherr, chief executive officer of the Diamond Producers Association, said: "Some people are still stuck on an outdated perception of what the diamond industry was around 15-20 years ago. The reality today is much different — we champion work with local communities which was seen to generate \$16 billion in net positive socioeconomic and environmental benefits."

Lab-grown diamond companies aren't willing to back down just yet though. It has recently been announced that the Lab-Grown Diamond Council has commissioned an audit to be undertaken by SCS Global Services, which will measure how six lab-grown diamond companies and retailers perform in terms of governance, as well as environmental and social impact. You can read more about this project here: jckonline.com/editorial-article/lab-grown-diamonds-eco-closeup

Will this mined diamond PR offensive have a long-term impact? Or is it simply the case that mining, in any form, has become an unfashionable and misunderstood pursuit in our eco-age? Read the complete *Total Clarity* report now at totalclarity.naturaldiamonds.com. ■

Assorted rough diamonds from South Africa. Image credit: DPA.



TIME FOR TREATMENTS

When it comes to gemstone treatments, there is always something new to learn. For gemmologist, photographer and *Gems&Jewellery* contributor, E. Billie Hughes, a new grant offers the opportunity to tackle some unanswered questions about low temperature heat treatments in corundum. Here, she explains why her research will benefit the trade.

Earlier this year, E. Billie Hughes was awarded the American Gemological Association's (AGA) 2019 Gemological Research Grant. This coveted financial reward of US\$10,000 gives one gemmologist the chance to test their theories and conduct an extensive research project into a particular area of gemmology. For Hughes, this area is corundum.

Using the grant, Hughes will now embark on an experiment-heavy project that centres on chief value determinants in sapphire and ruby, specifically heat treatments and origin. She will work to discover the extent of alteration possible in corundum through heating, especially at low temperatures, which have only recently been acknowledged by laboratories and often go unreported.

To understand more about this interesting area of study, *Gems&Jewellery* spoke to Hughes to find out what she plans to do and what she hopes to achieve over the coming months.

What can you tell us about your research project and how do you hope it will benefit the trade?

I will be working on a project that focuses on conducting heat treatment experiments on corundum. Our laboratory, Lotus Gemology, specialises in testing ruby and sapphire and we are based in Bangkok, Thailand, which is the heart of the world's ruby and sapphire trade. At our lab, we test more ruby and sapphire than any other gemstone and corundum is also one of the most historically well-known and commercially

significant gems. There is still so much to learn in the field of gemmology, and the deeper I get into it the more I realise that there are so many interesting things that we don't know enough about.

When it comes to ruby and sapphire, whether a stone is untreated or treated can have a significant impact on its value, so it's important to the trade that we are able to distinguish between untreated and treated material. I think anything that can help us improve the accuracy of our testing is of benefit to the trade.

You have developed an experiment-intensive study, can you offer any further details about this?

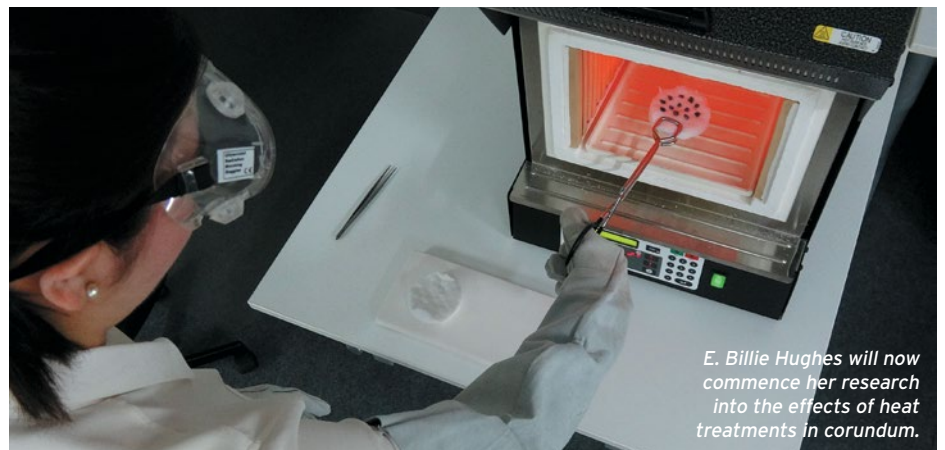
Our plan is to start with a selection of specimens that we are highly confident are untreated. We will examine them and record data in their untreated state. This will include photos to record the colour and appearance of the samples, inclusion photos and photos of the fluorescent

reactions of the samples. We also plan to record spectra including UV-Vis-NIR and Infrared spectra. Next we will heat the stones, starting at lower temperatures and eventually working our way up to higher temperatures. After each stage of heating we would take photos and run each test again to record any changes.

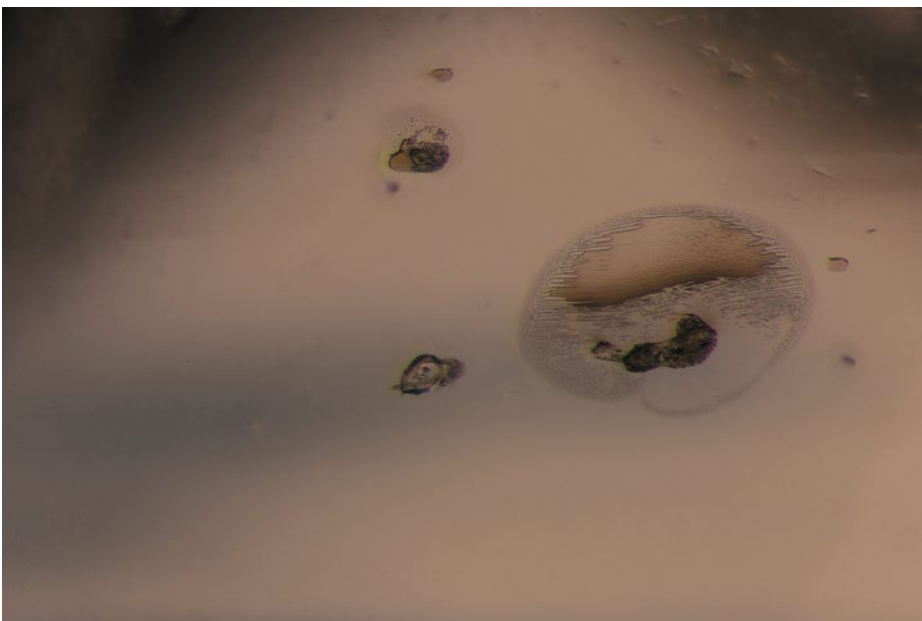
For this project I would like to see what temperatures start to alter the appearance of the samples and also whether changes are detectable with the series of tests we are running.

Do you think there is a need within the gemstone industry to become more adept at recognising treatments, both well-known and new?

As technology has improved, so too has the ability of treaters to enhance gems. Nowadays, because of the huge difference in price between untreated and treated gems, the incentive is greater than ever for treaters to try



E. Billie Hughes will now commence her research into the effects of heat treatments in corundum.



An inclusion scene such as this one is an example of the types of features Hughes will be recording in her study. In the first image (top), three transparent crystals are suspended in their untreated sapphire host. After heating to 1100°C (bottom), the changes are evident. All three crystals have developed tension fissures around them, the largest of which has partially healed to form a fingerprint shape with a shiny area.

to treat stones just enough to make a difference in appearance, but minimally enough to try to keep those treatments undetectable. Our job is to try to figure out how to detect even those subtle changes.

It's hard to say how often these treatments are going undetected because some of the changes are subtle, making it challenging to separate treated and untreated material. At the end of the day, despite huge advances in instrumentation, many of these determinations still rely on the microscope, which is an instrument

that relies entirely on the experience, skill, and concentration of the user. Despite the increasingly common use of advanced instrumentation in gemmology, there is still no 'black box' instrument that you can just put a stone into that spits out an answer. The knowledge and experience of the gemmologist is still of the utmost importance and I think continuing with research is crucial. I am sure that the individuals developing these treatments continue to experiment with new methods, so we gemmologists must also continue to experiment to find the best ways to detect them.

UNDERSTANDING SAPPHIRE HEAT TREATMENTS

Billie Hughes explains what makes heat treatment such an effective way of changing sapphire colour.

While sapphires can develop a richer colour at higher temperatures, some heat treatments are also aimed at lightening the colour (for overly dark stones or to reduce the bluish zones in Mong Hsu ruby).

The blue colour of sapphire is caused by what is termed ionic charge transfer between Fe^{2+} and Ti^{4+} ions. When these ions are near one another, light striking the stone will cause an electron to temporarily jump from Ti^{4+} to Fe^{2+} . During the process light is absorbed, creating a blue colour.

If you have a cloudy sapphire where the clouds consist of micro crystals of rutile (TiO_2), you can liberate the Ti by heating the gem up to dissolve some or all of the rutile (1500°C or more). This provides the Ti^{4+} needed for a blue colour. Fe can exist in corundum in the +2 or +3 valences. A blue colour in corundum needs Fe^{2+} . So, when dissolving the rutile by heating, if you do this with a reducing atmosphere, you will transform Fe^{3+} to Fe^{2+} , satisfying the second requirement for a blue colour.

On the other hand, if you want to lower the amount of blue in sapphire, you would do the reverse, heating the gem in an oxidizing atmosphere (at 800-1200°C). This converts Fe^{2+} to Fe^{3+} , thus removing blue. In addition, heating in an oxidizing atmosphere causes the splitting of the $\text{Fe}^{2+}\text{Ti}^{4+}$ pairs if the stone is cooled rapidly enough.

When can we expect to see the results of your work?

I have one year to work on the project and present the results. Our goal is to produce a paper detailing our findings, which will be published so everyone would have access to it. The AGA also hosts a conference every year during the Tucson gem show so that would be an ideal venue to discuss the findings with the organisation. ■

All images courtesy of E. Billie Hughes.

WE CAN'T LIVE WITHOUT...

Can you imagine the field of gemmology without the refractometer? Here, Gem-A Instruments assistant, Sophie Cox, traces the history of this vital piece of equipment from the early 1900s to the present day.

1907

THE HERBERT-SMITH REFRACTOMETER

The extraordinary history of the refractometer can be traced back to 1905 when Dr Herbert Smith, pioneering gemmologist and former Gem-A president, designed an instrument intended especially for identifying gemstones based on their refractive index.

Simple in design, the original model featured a glass hemisphere and used the phenomenon of total internal reflection. This involves light passing through the glass hemisphere from a suitable light source and being reflected from the gemstone surface to produce a scale reading of the critical angle from

which you can calculate the refractive index of the gemstone.

As expected of early inventions there were some restrictions including the size of gem material that could be tested and its suitability for stones with a higher refractive index than 1.775.

Clearly some improvements could be made to model one and so in 1907 Herbert Smith introduced a second model (1). This newer version allowed for more diversity in the shape and size of gem material for testing, and what's more, the scale was already calibrated ready to use with sodium light for direct reading of refractive indices.

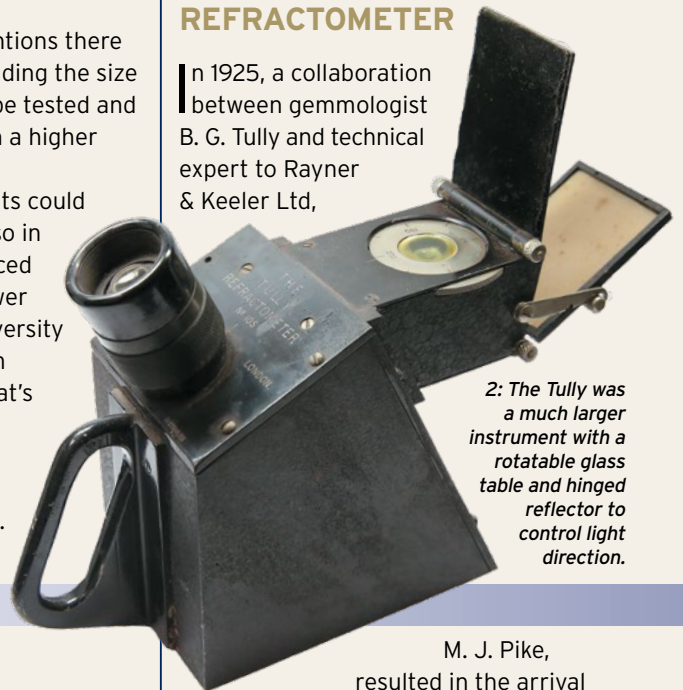


1: A more practical design in comparison to the Herbert-Smith model 1 in which a component part restricted the size of the stone.

1925

THE TULLY REFRACTOMETER

In 1925, a collaboration between gemmologist B. G. Tully and technical expert to Rayner & Keeler Ltd,



2: The Tully was a much larger instrument with a rotatable glass table and hinged reflector to control light direction.

M. J. Pike, resulted in the arrival of another new style of refractometer, the Tully (2).

The Tully was noticeably larger than Smith's creations and consisted of a dense glass hemisphere table. It was cleverly designed to allow the user to rotate the glass table instead of rotating the actual stone itself, thus avoiding damage to the soft glass. The differences did not stop there. Interestingly, the scale read from the bottom and, perhaps most significantly, up to a reading of 1.86 to allow for gemstones with a higher refractive index, such as garnet, to be tested. The use of a reflector controlled the light travelling on to the glass hemisphere to ensure more accurate results.

The early part of the 20th century was an exciting time of invention and innovation in the gemmological industry, perhaps most notably the development of one of the most important instruments used in the science of gemmology today: the refractometer.

A valuable piece of equipment, a refractometer measures the refractive



3: The Rayner had a sleek design for the era and featured a glass prism instead of a glass hemisphere.

1936

THE RAYNER REFRACTOMETER

In 1936, the introduction of the Rayner refractometer meant further changes in design and an overall sleeker appearance in comparison to previous models (3). Most notably the glass hemisphere was replaced by a smaller glass prism, and the addition of a hinged lid, which is remarkably similar to modern designs still in use today.

Developments in the Rayner design resulted in the Dialdex refractometer (4), which removed the usual scale and instead used an external dial on the side of instrument. The user turned the dial in order to measure the refractive index, with the main advantage being the scale on the drum allowing for easier reading to three decimal places.

4: The Rayner Dialdex refractometer had a similar design to the original Rayner but with an external dial instead of the traditional internal scale.



index (RI) of a gemstone by finding the critical angle, otherwise known as the angle of incidence, above which total internal reflection occurs. It is the ideal instrument — simple to use with enough training and practice and easy to repeat for a wide selection of faceted, loose and mounted gemstones.

At Gem-A HQ in London, we have a fantastic collection of refractometers dating from the early 1900s. These historic and contemporary gemmological

tools shine a light on our industry and the important role that Gem-A has played in advancing the study of gemmology since 1908.

The refractometer has undergone huge transformation since its humble beginnings back in the early 20th century. Today, the ability to measure the RI of a stone is a critical factor in the successful identification of gem material and the refractometer a most valued instrument amongst gemmologists. ■

All photographs by Henry Mesa.

c.1930s

ANDERSON-PAYNE SPINEL AND DIAMOND REFRACTOMETERS

Expert gemmologists continued to experiment with instrument design during the 20th century, including Basil Anderson and James Payne, who created the first spinel and diamond refractometers.

The spinel refractometer featured a prism of synthetic white spinel instead of soft glass used in



5: The diamond refractometer features a diamond prism and adjustable eyepiece to allow the user to read the larger scale range.

traditional models. A chief advantage of white spinel is its similarity in dispersion with numerous other gemstones, resulting in clearer shadow edges when using a white light source. The shorter RI range and more open scale allowed for more precise readings.

The diamond refractometer (5), now part of the Gem-A collection, had a prism of diamond manufactured from a 6.632 carat gem. The scale range from 1.55 to 2.05 had the obvious advantage of testing gemstones with much higher refractive indices.

2019

THE GEM-A REFRACTOMETER

The current Gem-A refractometer (6), now widely used in the industry, is similar in appearance to the Rayner model and also cleverly designed with a built-in monochromatic sodium yellow filter to ensure a sharper shadow edge when measuring refractive indices.

It offers great versatility by being able to test materials with an RI range between 1.35 and 1.81 and with a variety of guises, including faceted stones, cabochons, larger carvings and crystal faces as well as many mounted gemstones. The removable polarising filter for the eyepiece helps to clarify refractive index and birefringence readings.



6: The Gem-A refractometer is an ideal and compact instrument for measuring refractive index with a built-in monochromatic filter, hinged top cover and polarising filter.

The Gem-A refractometer is available from the Gem-A Instruments shop, priced at **£480**, which also includes a bottle of 1.79 RI liquid. 1.81 is also available, priced at £82.80. Current Gem-A Members and students receive a **10% discount** on instruments.



GEMSTONE CONVERSATIONS: TOPAZ

In the final instalment of his Gemstone Conversations series, jewellery historian and valuer, John Benjamin FGA DGA FIRV focuses on topaz, exploring its symbolism, fluctuating popularity and evolving style in jewellery over the centuries.

In this, my final gemstone conversation, I shall be looking at topaz — that most elegant and subtle of gems. I studied first year gemmology in the early 1970s. Our excellent tutor, Denis Inkersole, invited the class to try to identify a topaz in a small parcel of brown gems purely from touch alone. I distinctly remember that ‘slippery’ feel of the topaz — so very different from the assorted citrines and zircons making up the rest of the parcel. This ‘slippery’ characteristic of topaz proved very helpful a number of years later when I was asked to value a Georgian necklace of large, graduated pink stones described on an old valuation as ‘foiled rock crystal’. Needless to say, they were high grade pink topaz — and worth a small fortune.

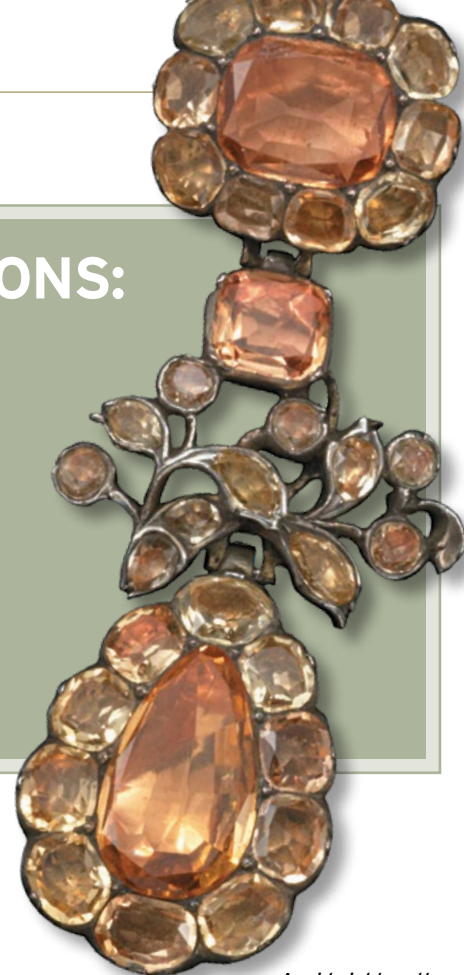
Topaz is a rather enigmatic stone; if only it were as popular today as it was 200 years ago. Today, while it is appreciated by gemmologists, dealers and the public, it only seems to be used sparingly in contemporary designer jewellery. True, the blue variety is decidedly affordable and seems to have widespread appeal but most of this material is irradiated and heat treated. A personal opinion, of course, but modern topaz simply doesn't have the pedigree or desirability of the rare and beautiful brown and pink varieties so favoured in Georgian times.

Topaz has been used in decorative jewellery for centuries. No doubt due to its association with purity and goodness, it was favoured by cardinals and bishops in their ceremonial rings. George Frederick Kunz, leading gemstone and jewellery authority (after whom kunzite was named) remarks in his celebrated book *Rings For The Finger* that topaz was “the most honourable of stones above all other stones” and goes on to say that Pope Innocent III (1198-1216) sent Richard Coeur de Lion four gold rings each set with a different symbolic stone.

He writes that the “verdant hue of the emerald signifies how we should believe, the celestial purity of the sapphire how we should hope, the warm colour of garnet how we should love and the clear transparency of topaz how we should act”.



A Victorian orange topaz brooch. The large flat table on the topaz exhibits the typical form of cutting reserved for this stone.



A mid eighteenth-century topaz pendant fully enclosed in silver (possibly one of a pair of earrings) exhibiting the typical colour that is often seen in mid-eighteenth century Continental topaz jewellery.

The gem was used in Renaissance jewellery as a relatively inexpensive stone in simple pendants and rings while colourless topaz was an effective substitute for diamonds throughout the 16th century. Its use never really flagged over the next 200 years in Continental Europe and, with advances in diamond cutting and setting, the soft, golden brown tones of topaz made an ideal accompaniment for table-cut and rose-cut diamonds in large, formal dress jewels such as stomachers and bodice brooches. The topaz used in these grand



A typical late Regency period French pink topaz parure, circa 1830.

constructions were generally flat-cut and of oval and cushion shape. Gold was rarely used; the universal setting was silver or occasionally silver gilt and, unlike nineteenth-century mounts, the stones themselves were fully enclosed at the back and sometimes foiled to enhance colour and overall appearance.

As popular as it may have been in early Continental jewellery, the 'Golden Age' for topaz only really took off once Portuguese traders began to exploit the vast mineral resources of Brazil.

By the middle of the 18th century large, fine quality crystal specimens were being shipped to Lisbon and Porto where they were cut by lapidarists and set by jewellers in a wide range of jewels, including ornate pendants and brooches, necklaces and extremely



A Regency foil-back pink topaz, turquoise and pearl set cross in a typical cannetille work gold frame.

long earrings that brushed the shoulders of the wearer. Eighteenth-century topaz jewellery is highly sought after today for its beauty and rarity although many examples available on the market today are modern reproductions or have been put together from several other pieces.

These days, topaz is best known for its abundant use in Georgian jewellery. The early 1800s was the era of sentimentality and romanticism and topaz, alongside



A Victorian pink topaz and diamond pendant exhibiting the particular richness of topaz in nineteenth-century jewellery.

other gems of subtle appearance such as aquamarine and chrysolite, was highly compatible for use in the delicate, feminine gold jewels popular at that time. The archetypal Georgian or Regency parure would be composed of large, bright, oval-shaped topaz mounted in gold filigree-style frames known as *cannetille* work, together with a

Topaz is a rather enigmatic stone; if only it were as popular today as it was 200 years ago.

chandelier brooch called a *girandole*, a pair of matching bracelets and long pear-shaped earrings. Rings would be set with a foil-backed golden or pink topaz in a surround of half pearls while the gem is often found today in a broad range of sentimental jewels including keys, hearts, padlocks and jewelled anchors. *Rivières* – necklaces of graduated oval-shaped, foil-backed stones – were also popular at this time and have enjoyed something of a revival today, no doubt due to their simple, elegant and timeless construction.

The continued use of topaz throughout the Victorian era in large, diamond-set gold brooches and rings experienced a late surge

in popularity in Russia at the end of the 19th century when deposits were discovered in the Ural Mountains. So-called 'Imperial' topaz was named in honour of the Czar and is notable for its lovely pinkish-gold colour. Unsurprisingly, it was selected by leading jewellers and goldsmiths such as Fabergé in diamond-set brooches of Neo-Classical inspiration, evoking the lapsed styles of the Regency era.

As the 20th century progressed, topaz seemed to lose its popularity as the fashion for architectural diamond jewellery of the Art Deco era began to surge. Somehow, golden-brown gems in diamond and platinum frames didn't quite have the same appeal as ruby, sapphire, onyx and emerald and, while brown stones certainly became fashionable after the War, these were almost all citrines – far cheaper than costly topaz.

If ever there were a gem which is due a revival, and a proper reassessment of its unique, ethereal beauty, it must be the topaz. ■



A white topaz brooch with enamel decoration (right) alongside a goshenite mounted pendant (left), both by Carlo Giuliano.

John C Benjamin FGA DGA FIRV is an independent valuer, jewellery historian and author of *Starting To Collect Antique Jewellery*. Find out more at johnbenjamin.co.uk



Gem-A

THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN

Membership Matters

During the latter half of 2019 and moving into 2020, we will be focusing on what it means to be a Gem-A Member and how we can improve and enhance your experience with us. Discover here how Gem-A Membership is setting out on a new path...

What does Gem-A Membership mean to you? As you are reading this magazine, you are already benefitting from one of the perks of being a Gem-A Member: access to *Gems&Jewellery* magazine and *The Journal of Gemmology*.

Of course, we know that Gem-A Membership is about more than magazines. It's about being part of a highly regarded and respected global network of gemmology professionals, rooted in the completion of comprehensive practical and theoretical training.

As the world's longest running international provider of gem and jewellery education, Gem-A Membership includes world-leading gemmologists, geologists, jewellers, goldsmiths, scientists, mining specialists, diamond graders, sales associates and research fellows. We are incredibly proud of the professional and geographic diversity that can be found among our ranks; something that is bolstered by an ever-growing network of accredited teaching centres (ATCs) across the world.



We currently offer a range of Membership options that accommodate alumni of our Gemmology Diploma and Diamond Diploma courses, corporate businesses and individuals without gemmology qualifications (or current students) who can apply for Associate Membership. Currently, Membership benefits include discounts at Gem-A Instruments; discounts on Gem-A workshops; free-to-attend Gem Central events; access to an online Member's area; affiliate membership of the Mayfair-based Naval Club; member-only rates for accommodation at the Rosewood London hotel; a 10% discount at Hatton Garden-based gemstone dealer, Marcus McCallum; and our two publications, delivered to your door on a quarterly basis.

IMPORTANCE OF FGA DGA

Those who have successfully completed the Gem-A Gemmology Diploma or Diamond Diploma and apply to become Members can use the letters FGA (Fellow of the Gemmological Association) or DGA (Diamond Member of the Gemmological Association) after their name. These post-nominals are an exclusive Membership benefit that demonstrate knowledge and professionalism on an international level.

We have been successfully inviting Gem-A Graduates to become Fellows since 1931. Unfortunately, one of the most common mistakes in the wider Gem-A community is the misuse of post-nominals, more specifically by those who have completed Gem-A courses but are not



“ I like the idea of being an FGA member and it also assists me to demonstrate to people that I am a certified gemmologist. ”

Members. We remain committed to making sure everyone associated with Gem-A understands this distinction.

MAKING MEMBERSHIP EASIER

Looking ahead, we are on a mission to streamline the Membership process, ensuring it is as stress-free as possible. Our first port of call is improving the ways in which the Membership fee can be paid. If you are based in the UK, you can now simply set up a direct debit to pay your Membership subscription fee via the easy, secure and convenient service, GoCardless. For those outside the UK, there is the option to pay via PayPal.

Thanks to the feedback of our Members, we will also be sending out additional renewal reminder emails from now until the renewal deadline in early 2020. To make sure all our communications arrive with you safely, please make sure we have your up-to-date details. You can provide us with a new postal and email address by contacting membership@gem-a.com. In the near future you will be able to do this yourself by logging into the Gem-A website.

WE'VE LISTENED TO YOU

We asked what you would like to see introduced to Gem-A Membership... and here's what you said!



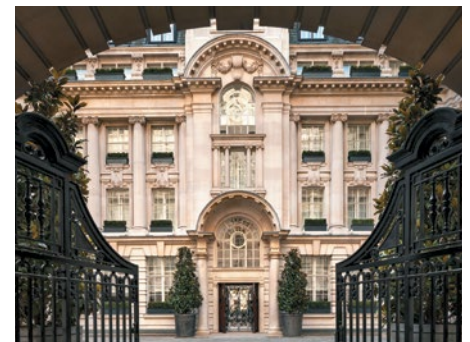
“ Gem-A is a fantastic organisation that brings the world of gemmology together. ”

Continuing Professional Development:

Sometimes we all just need a quick reminder or to brush-up on the basics. We are plotting a series of online refresher quizzes to keep your knowledge fresh, as well as further professional development initiatives that reflect the ever-changing nature of our trade. Don't forget the Gem-A Conference is a great way to be inspired.

Gem-A Alumni Groups: As we move ahead into 2020, we will begin to acknowledge Gem-A alumni groups in a more meaningful way. To do this, we will support informal and more formal gatherings of Gem-A Members and alumni, while also prioritising accurate representation of Gem-A brand values, like the use of logos, post-nominals and branding. If you would like to establish

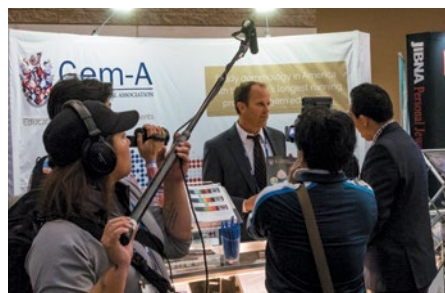
a Gem-A alumni group in your region or country, please contact us. As we go through this process of transition and change, we would like to thank you for your patience and continued support.



Gem-A Members receive preferential rates for stays at the Rosewood London.



Field Trips: Gemmology is a global profession and we are committed to professional development in all its forms, including field trips. As a very small team, organising large group adventures can be a challenge. However, we are partnering with organisations wherever possible to expand our horizons. Take, for example, the trips to Sri Lanka we have hosted with the National Association of Jewellers (NAJ), over the last two years.



Gem-A has more than 110 years' experience at the forefront of gemmology education, and while producing the finest calibre of gemmologists remains our defining purpose, we are also committed to creating a Membership Association that is engaged, interactive and mutually supportive. If you believe you can help in this endeavour, please share your views via membership@gem-a.com ■

A BIG THANK YOU!

We would like to thank our Corporate and Gold Corporate Members, who continue to support the goals and initiatives of Gem-A. If you would like to find out more about Corporate Membership, please contact membership@gem-a.com

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- Heidi Kjeldsen Ltd
- Fair Trade Gemstones Ltd
- ShangrilaGems
- Nimmi Blu Designs Ltd

Gold Corporate

- Serendipity Diamonds
- Scarab Antiques
- MacIntyres of Edinburgh
- Fabula Gems
- AnchorCert, Birmingham Assay Office

Gold Corporate

- W. Carter & Son

- Global Gem Testing Laboratory Sri Lanka
- BD Luxury
- E.W. Balasuriya & Co. Pvt. Ltd
- Canadian Gemmological Association (CGA)
- The Rock Hound
- B.K.T. Rings
- Chenevix Jewellery
- Holts

- Levy Gems Ltd
- Lucas Rarities Ltd
- F Hinds Ltd
- M&J Gems Ltd
- Japan Germany Gemmological Laboratory
- L & G Webb
- Berganza Ltd
- AGGL
- George Pragnell Ltd

- Gemworld
- Gemological Appraisal Laboratory of America
- Jewellery Quarter Bullion
- Searle & Co. Ltd
- D. Barker & Son Ltd
- A. E. Ward & Son
- Marcus McCallum
- JTV
- The Ebor Jetworks

Magnificent Emeralds

A new exhibition of exceptional emerald specimens at the Wilensky Gallery in New York has wowed even the most devoted collectors. Here are some of the most mind-blowing specimens on display...

EMERALD, SWAT VALLEY ►

Khyber Pakhtunkhwa, Pakistan (8 cm tall × 6 cm wide). Dr Eugene and Roz Meieran Collection.

The modern history of this emerald locality starts in 1958, when emeralds were found during the reign of the last Wali Ahad (Crown Prince) of the former Swat State, Prince Miangul Jahanzeb. At that time, all of the region, and the emerald mines, were owned and operated under the authority of the Prince. Within a decade, the government of Pakistan took control of all royal-owned lands, and the mines continued under strict government rule. In 1958, it was unknown that these emerald mines were actually ancient, and likely among the earliest known in the world. About 20 years ago, a group of researchers, employing a method of analysing oxygen isotopes, discovered that some Roman period (about 2,500 years old) emerald jewels most likely came from the Swat Valley mines.



▲ QUARTZ WITH EMERALD INCLUSION

Muzo Mine, Muzo Municipality, Vasquez-Yacopi Mining Dist., Boyacá Dept., Colombia (7.3 cm tall × 3.1 cm wide). Private collection.

This amazing inclusion is believed to be, according to the GIA, the only known example of a gem quality emerald included in quartz. Many feel it holds the title of finest known inclusion of all time. The specimen is well-known, having been featured on a National Geographic TV Special, entitled the "\$400 Million Dollar Emerald." It is also pictured in *Emeralds: A Passionate Guide* by world-renowned emerald expert, Ronald Ringsrud.

Magnificent Emeralds: Fura's Tears' opened in a vibrant burst of green on September 26 at the highly-regarded Wilensky Gallery in New York City. The exhibition offers a spectacular selection of natural emerald specimens, alongside storytelling inspired by pre-Colombian myths about the verdant gem itself.

The 25 emeralds on display are described as "masterpieces," including 'The Three Amigos' — a specimen with three of the finest known emerald crystals ever found embedded within its original matrix. In addition, a quartz with an emerald inclusion, the only known example of its kind, is also included in the exhibition, with many describing it as the "finest inclusion of all time".

The 'LKA' and 'Stephenson' emeralds will also be exhibited, the second and fourth largest emerald crystals ever found in North Carolina, respectively. In the past 140 years only nine emeralds

over 1,000 carats have ever been unearthed in the state of North Carolina.

The exhibition will run until December 30 and a visit is highly-recommend. To give you a taste of what to expect, here are pictures and the stories behind some of the most exciting specimens... ■

To find out more about the Wilensky Gallery, please visit wilenskyminerals.com.

**'The Three Amigos' –
a specimen with
three of the finest
known emerald
crystals ever found..**

EMERALD ON CALCITE: 'THE THREE AMIGOS' ▼

*Coscuez Mine, Muzo Municipality, Vasquez-Yacopi Mining Dist., Boyacá Dept, Colombia (5 cm tall × 4 cm wide).
Ex Joseph Freilich & Cargill Family Collection.
Currently in the collection of Mr. Irv Brown.*

This superb gem quality emerald specimen was christened with the name 'The Three Amigos' while on display in a GIA exhibition in Carlsbad, California (2018). This specimen has three of the finest known emerald crystals ever found, embedded within its original matrix. The crystals have a bright, vivid green colour, and are a near flawless quality rarely seen in any emerald specimen.



EMERALD, JOS PLATEAU ▲

*Plateau State, Nigeria
(6.5 cm tall × 1.5 cm wide).*

Dr Eugene and Roz Meieran Collection

Emeralds from Nigeria are quite different than those from Colombia. Discovered in the late 1980s, they form long, slender crystals with unique colouration. The colour of Nigerian emeralds lean more towards blues and a bit less towards greens. The crystals are always elongated, looking more like the beryl variety, aquamarine. In fact, within the very same mining region, aquamarines with a deep blue vibrant colour are found, in the exact same crystal form. The emeralds from Jos tend to have a far superior clarity, with very little 'jardin' compared to most other localities. They are often considered to have the best clarity.

Nigerian emeralds have never been found attached to a matrix, and are sometimes doubly terminated. The terminations are also very different from most other known emeralds. They terminate similar to aquamarine, having a complex steep pinacoid termination. When these emeralds were first brought to market, there was an ongoing debate as to whether they could be classified as true emeralds, as they were so markedly different from the traditional emerald. Today, Jos emeralds are completely accepted and treasured among emerald collectors. They are extremely rare, and new specimens have not been found for many years.



Activity on Gem-A's London-themed stand.



The Gem-A Gathering in full swing at Assaggio Trattoria Italiana.

Reporting from Hong Kong

At what was a noticeably quieter Hong Kong Jewellery & Gem Fair in September, the Gem-A team were busy meeting ATCs, chatting to students and discussing some exciting future projects...

Anyone who has watched the news in recent months will have noted the unrest in Hong Kong. Concerns about the protests did cast a shadow over the recent Hong Kong Jewellery & Gem Fair, held at AsiaWorld-Expo from September 16-20, and at the Hong Kong Convention and Exhibition Centre from September 18-22, however, our team witnessed no trouble during their visit.

On September 19, the third annual Gem-A Gathering took place and welcomed more than 100 gemmologists, accredited teaching centre (ATC) representatives, students, colleagues and peers from across Asia. In a change to previous years, the event took place at Assaggio Trattoria Italiana in the Hong Kong Arts Centre, which proved to be a fantastic venue with a lively atmosphere. The following morning, an ATC breakfast meeting hosted eight ATCs from China, Taiwan and Hong Kong. During the session, our head of Asia, Anne Carroll Marshall, head of education, Nysa Pradhan, head of China, Jessica Han, and marketing manager, Elaine Ruddle, delivered a presentation on promoting Gem-A education, protecting the heritage of Gem-A and how we can continue to work together to further the study of gemmology worldwide.

On Saturday 21, we announced the recipient of a special Highly Commended accolade as part of the annual Gem Empathy Award, which is hosted by International Jewellery London (IJL). Due to the rule that designers must be in attendance at IJL in order to qualify for the competition, many fantastic entries from designers across Asia could sadly not be counted. To remedy this, we decided to celebrate the high level seen in the entries by naming Wan-Yi Lin as a Highly Commended winner of the Gem Empathy Award 2019. Her 18k



Wan-Yi Lin's Highly Commended design, *Goldfish Girl*, which was recognised as part of the annual Gem Empathy Award.

gold Goldfish Girl design, which is inspired by Japanese Ukiyo-e and monsters, makes an eye-catching use of a precious coral cabochon.

Gem-A would like to thank Wu Chao Ming and the Taiwan Gemmological Institute (TGI) for taking part in the 'Meet an Accredited Teaching Centre' activity. We would also like to thank all the ATCs, students and Members that we had the pleasure of meeting whilst in Hong Kong. We look forward to seeing you there again in 2020. ■



Gem-A CEO Alan Hart, and head of Asia, Anne Carroll Marshall with Wan-Yi Lin and her former tutor from TGI, Mei Shen.



Alan Hart and Anne Carroll Marshall with shortlisted entrants to the Gem Empathy Award in Hong Kong.

GEM-A INTERNATIONAL SCHEDULE 2020

Want to say hello to us? We will have a presence at these shows in 2020:

International Jewellery Tokyo (IJT)

20-23 January

AGTA GemFair Tucson

4-9 February

JCK Las Vegas

2-5 June

Hong Kong Jewellery & Gem Fair

13-19 September



Gem-A
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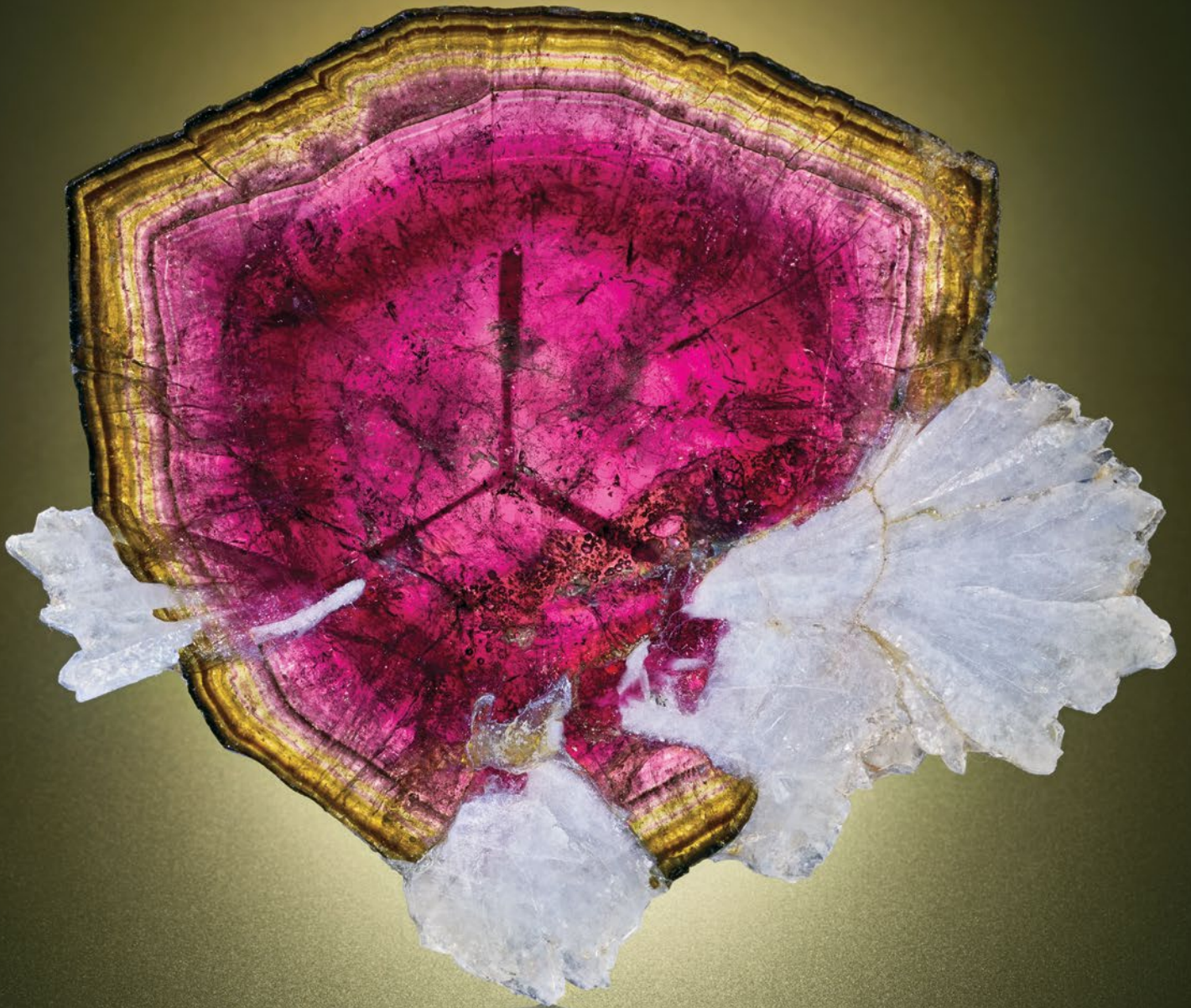
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