# Gems & Jewellery

Winter 2018 / Volume 27 / No. 4

EMERALDS IN PAKISTAN

RUSSIAN WONDERS

LOOKING TO LIVERPOOL

SIGNATURE JEWELS

GOLD SHEEN SAPPHIRES

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

# Accredited Gemologists Association

AGA

*Join some of the world's **leading gemologists & gem/jewelry professionals** in a non-profit, peer society, dedicated to upholding the highest standards of ethical practice.*

## AGA Membership Benefits

- Superlative continuing education, access to cutting edge research, & valuable networking opportunities
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- AGA Educational Scholarships & Research Grants
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Education
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& Integrity

Gems&Jewellery
WINTER 2018

## EMERALDS IN PAKISTAN

Charles Evans FGA DGA shares some highlights from his trip to the Swāt Valley in Pakistan, exploring the region's emerald deposits.



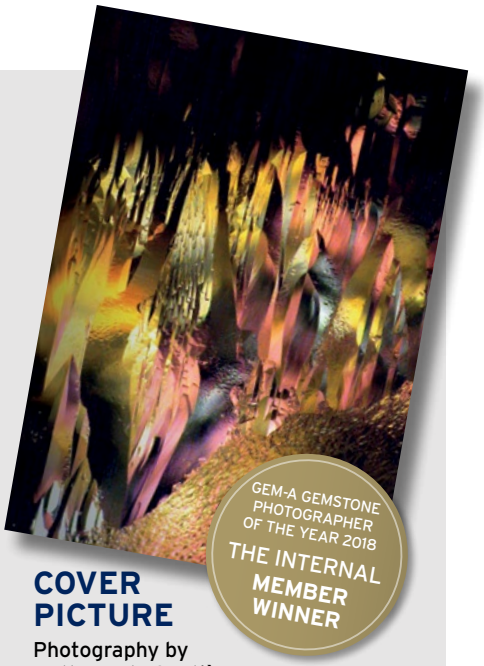
## RUSSIAN WONDERS

Ever wanted to explore the treasures of Russia? Here, Patricia Campion takes us on a gemmological tour of the Ural Mountains and the cultural dazzles of St Petersburg and Moscow.

## GOLD SHEEN SAPPHIRES

Thanh Nhan Bui explores the beautiful and infinite optical variations in a new variety of 'Gold Sheen' sapphire from Kenya.




## COVER PICTURE

Photography by Anthony de Goutière G.G GIA C.G. AGS

Colourless beryl crystal specimen measuring 6.00 x 3.00 x 5.00cms. Weighing 140cts. For this photomicrograph Anthony used two pinpoint illuminators set at different intensities and angles, and transmitted light with partially-crossed polarisers.

The area photographed is approx. 2.00mm by 3.00mm and is part of a rippled area (growth patterns) on one edge of the specimen. This rippled area measures approx. 1.00 x 2.50cms.

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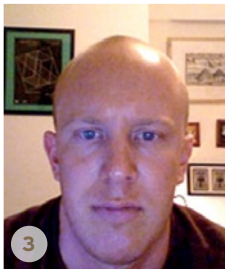

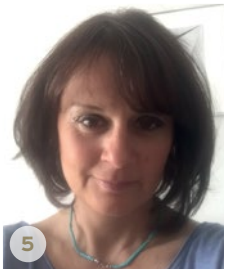

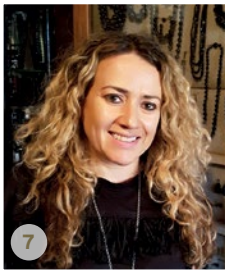
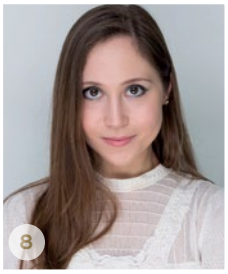

# Gems&Jewellery

## Winter 2018 featured contributors

### 1. JAN ASPLUND

Jan Asplund FGA DGA, is a freelance gemmologist consultant and teacher with a special interest in the history of gemstones. Jan has been teaching gemmology and lapidary at Luleå Technical University and is a board member of the Swedish Gemmological Association. He regularly writes texts and articles for gemstone and jewellery publications, as well as giving lectures at gem and jewellery conferences.

### 2. THANH NHAN BUI

Thanh Nhan Bui is a civil engineer and researcher working at the Université Catholique de Louvain, Belgium, in the field of nanophysics. His current PhD thesis is about electronic properties of bismuth thin films at low temperature. He is a lecturer at HRD Antwerp and SRBG (Société Royale Belge de Gemmologie), and he collaborates with HRD Antwerp, CRG (Gemmological Research Center of Nantes) and Almini Beijing Trading Co. Ltd. (亚米尼北京贸易有限公司) on gemmological research.

### 3. DR ASHLEY COOKE

Dr Cooke is senior curator of Antiquities at National Museums Liverpool. He was lead curator for the permanent gallery *Ancient Egypt: a journey through time* that opened at World Museum on 28 April 2017, the UK's second-largest Ancient Egypt gallery after the British Museum. He studied archaeology and egyptology at the University of Liverpool, gaining a PhD in 2006.

### 4. DACQUES NINI

Founder of Dacques, a wholesale and bespoke jewellery company, Dacques Nini GG 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.

### 5. DR CHRISSY PARTHENI

Dr Partheni trained in archaeology at Aristotle's University, Thessaloniki, Greece. She has worked for National Museums Liverpool for 18 years in various roles including education and partnerships. She is passionate about making collections widely accessible through national and international loans, exhibitions and digitisation projects.

### 6. ROSEY PERKINS

Rosey Perkins GG is an independent gemmologist and gemmological photojournalist based in London. She is particularly fascinated by corundum and its origin. Having travelled with Vincent Pardieu (fieldgemology.org) on field expeditions to Vietnam, her travels can be read about at: *roseyperkins.com*

### 7. SARAH STEELE

Sarah Steele FGA DGA is a geologist and professional lapidary. She is a specialist in Whitby Jet and natural thermoset and thermoplastic materials used in the production of 19th century jewellery. Most recently, Sarah has been collaborating with the Asociatión Azabache Jurásico de Villaviciosa in Spain on a Jurassic jet project, which received the European Cultural Heritage Seal in 2018.

### 8. CHRISTA VAN EERDE

Christa Van Eerde's MA MLitt FGA DGA 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'. The decision to spell her name with a 'Ch' was in honour of Christa McAuliffe, scheduled to be the first teacher in space and one of the seven crew members killed in the Space Shuttle Challenger disaster.

### PATRICIA CAMPION

Patricia Campion has been a dedicated member of Gem-A for many years, contributing to the Gem-A Blog and never missing a Gem Central event. Her gem experience has seen her travel to various various regions across the world, including Russia, Idar-Oberstein, Sri Lanka and Myamnar.

# Straight from the heart

## Opinion and comment from CEO, Alan Hart FGA DGA

With the whirlwind of the Gem-A Conference behind us, December is the perfect opportunity to take stock and reflect. I hope you will agree that this year's Conference was a storming success, with some fantastic presentations, a marvellous evening on the Thames, and some great, hands-on field trips which always inspire. Thank you to everyone who attended, all our sponsors, speakers and, of course, the Gem-A team for making the whole thing possible. I must also mention this year's graduates, who we were thrilled to honour at the Gem-A Graduation Ceremony at the Royal Institution on Monday, November 6. Introducing new faces (and enthusiasm) into our field is something that we should all value, especially as the next generation will need to continue the fight against internet mis-information.

I know you will all be very disappointed to hear that this is the last issue of *Gems &Jewellery* this year. We will be back in the spring of 2019 with more fantastic features and insights supplied by our wonderful community of contributors. If you have a brainwave this winter, please do contact the *Gems&Jewellery* editorial team with your ideas — they will be happy to help transform your concept into a feature.

This issue has a slight international flavour, with field trip reports as far afield as Colombia, Canada, Pakistan and Russia. We also have fantastic behind-the-scenes insights from the World Museum in Liverpool, and an interesting read on 'Gold Sheen' sapphires. In this issue you will also find the five shortlisted finalists and overall winner of our annual Gem-A Gemstone Photographer of the Year competition. We are always thrilled to see so many talented photographers, both amateurs and professionals alike, showcasing their skills and capturing the often-surreal beauty of gems. You will undoubtedly see more of this year's entries in editions of *Gems&Jewellery* in 2019.

December also means festive gifting and holiday excitement. Gem-A Instruments is offering 25% off selected books while stocks last, and don't forget to get your orders in for a whole host of gemmology-themed holiday gifts. They may not look particularly sexy under the Christmas tree, but that new loupe will undoubtedly prove useful as we countdown to the Tucson gem shows in February! Speaking of gemmological equipment, I would like to draw your attention to page 27, where Gemmology Diploma student, Judy Zhang, tells us more about her novel SpectroAid that is a little stroke of genius. It is fantastic to see such a spirit of invention and innovation within our students, hastened along by the support of our tutors and staff.

*Alan Hart talks to Wallace Chan.*

*The Gem-A Graduates of 2018. Turn to page 22 to read more.*

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There is lots to look forward to next year, including a host of trade show visits, the continued growth of Gem-A overseas and another Open Evening event in January. Keep checking the Gem-A website and our social media accounts for more details in the coming weeks.

All that's left to say is Merry Christmas and Happy Holidays to all our members, students and friends. I would also like to take this opportunity to wish you a successful and prosperous New Year. We will see you in 2019.

Best wishes

**Alan Hart FGA DGA**

# Gem-A News

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

## NEW DESIGN PORTABLE POLARISCOPE!

**The new style portable polariscope is now easier and quicker to use than ever before and well worth the investment for both amateurs and professional gemmologists.**


More user-friendly without compromising on quality, the polariscope comes complete with two polarizing filters, a rotatable glass stage and a bright LED light powered by two easily replaceable CR2032 batteries, which enables clearer distinction between singly and doubly refractive gemstones. There is no assembly required, simply twist the bottom of the polariscope to switch on the light and you're ready to start gemstone testing.

A highly recommended piece of equipment, the addition of a lightweight case ensures safe storage and transportation when required. ■

**Retail price £65 + VAT**
Current Gem-A members and students receive a 10% discount on instruments

**If you require further information, advice or to simply make a purchase, please email instruments@gem-a.com**

## EVENTS

**Gem-A's Big Gem Bash!**

We have some exciting news for the future of Gem-A in the USA and look forward to sharing it with you at Gem-A's Big Gem Bash! Returning for its fifth year, the Big Gem Bash is THE place for gemmological networking. Register your attendance now!


big-gem-bash-2019.eventbrite.co.uk

## OBITUARIES

**Mrs Delia Pegg**

We are sad to announce the passing of Gem-A Member Mrs Delia Pegg who died on 18 October 2018. Delia's husband noted that she very much enjoyed her gemmology and our thoughts are with him and their family.

## EDUCATIONAL WORKSHOPS AT GEM-A HQ

21 Ely Place, London
gem-a.com/education

**Understanding Diamond Grading**
*10, 28 and 31 January 2019*

**Understanding Gemstones**
*10 and 28 January*

**Understanding Diamond Simulants**
*11 January 2019*

**Understanding Gemstones Testing**
*11 and 29 January 2019*

**Investigating Jade and its Imitations**
*8 March 2019*

**Diamond Grading and Identification**
*25 February – 1 March 2019; 1-5 April 2019; 8-12 July 2019*

**Diploma Preparation (new UK only)**
*28 January – 1 February 2019*

*Gem-A Members, Gem-A Students and NAJ Members £135; Non-member £165*

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**Google+**
The Gemmological Association of Great Britain (Gem-A)

**Instagram** @GemAofGB

Head to the **News & Blogs** section of **gem-a.com**

# INTERNATIONAL EVENTS

**Tucson 2019**

*Join us at AGTA, where we will be exhibiting in our usual place, upstairs in the Galleria, booth 29.*
*Tucson Convention Center, 260 South Church, Tucson, AZ 86702*
We will have our course notes available along with a demonstration of the handheld instruments that we supply to our students. For more information and to register, visit: **members.agta.org**

Sam Lloyd FGA EG, Gem-A Instruments Manager and Tutor at Gem-A, will deliver a workshop at the Accredited Gemologists Association bi-annual Conference at the Tucson Marriott University Park Hotel Conference Center, 880 E. Second Street, Tucson, AZ 85719.

This workshop will be one-hour long and will help to increase confidence in the use of handheld instruments. Register for the AGA Conference here: **accreditedgemologists.org**

**30th International Jewellery Tokyo**

*Tokyo Big Sight*
*For more information and to register your attendance visit the IJT website:* ***ijt.jp***
Ayako Naito, Gem-A's Chief Liaison Officer in Japan, will be available on our booth to answer questions, along with our ATC and GAPP centres from across Japan.

From Gem-A HQ, Senior Gemmologist Pat Daly FGA EG, will run a gemmological clinic each day on the booth. Need more help using a spectroscope? Want to understand more about emeralds? Visit the booth and ask Pat a gemmological question.


Check out Gem-A's Japanese Facebook page for details of the Gem-A members gathering taking place during the show. **You can find us at booth A9-33.** ■


*Image credits all © Gem-A*

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

Join us for a Gem-A HQ
Open Evening

Thinking of studying with us?

Want to see our incredible gemmological library for yourself?

Don't miss your chance to tour our London HQ, meet our tutors and learn something new.

Tuesday 15th January 2019

Drop-in between 4pm and 7pm at 21 Ely Place, EC1N 6TD

*For more information contact us at* ***education@gem-a.com***


GEM-A GEMSTONE
PHOTOGRAPHER
OF THE YEAR 2018
★ OVERALL ★
WINNER
Richard W. Hughes FGA

# And the Winners Are...

## The annual Gem-A Photographer of the Year competition encourages professionals and amateurs alike to grab their cameras and capture gemstones in new and exciting ways. Here, we reveal the shortlisted finalists and overall winner of this year's contest...

THE INTERNAL MEMBER WINNER

**Anthony de Goutière**
**GG GIA CG AGS**
*Colourless beryl crystal specimen measuring 6.00 x 3.00 x 5.00cms. Weighing 140cts. For this photomicrograph two pinpoint illuminators were used at different intensities and angles, and transmitted light with partially-crossed polarizers.*

*The area photographed is approx. 2.00mm by 3.00mm and is part of a rippled area (growth patterns) on one edge of the specimen. This rippled area measures approx. 1.00 x 2.50cms (featured on the cover).*

THE INTERNAL STUDENT WINNER

**Tyler Smith**
*A spire of negative crystals extends along the c-axis of this Sri Lankan 'ottu' sapphire bipyramid — a testament to its origin and untreated nature. FOV 4.79mm. Nikon SMZ1500 trinocular microscope equipped with a Nikon DS-Ri2 camera head. A polarizing lens was used to filter the doubling since the polished window was off the c-axis. The light sources were dark field illumination and diffused fiber optics (see Last Impression page 46).*

THE EXTERNAL MEMBER WINNER

**E. Billie Hughes FGA**
*When viewed in short-wave fluorescent illumination, a piece of blue sapphire rough from Madagascar displays striking hexagonal zoning along with unusual triangular patterns.*

THE EXTERNAL STUDENT WINNER

**David Pregun**
*Trigons on the culet of a faceted, old-cut diamond (photomicrography taken with smartphone camera).*

THE HUMANITY IN GEMS MEMBER WINNER AND OVERALL WINNER

**Richard W. Hughes FGA**
*Going for the Green: Traders scramble for Myanmar jade at Yangmei's night market in Guangdong Province, China (see main image left).*

THE HUMANITY IN GEMS STUDENT WINNER

**Maryam Mastery Salimi**
*Persian turquoise dealer near Mining Area, Neyshabur, Iran (taken with an iPhone). The location is the land of blue turquoise near a turquoise mine at Firouzeh village, Neyshapour city, South Khorasan county, Iran. A Persian turquoise dealer presenting a variety of Persian turquoise and his finest blue turquoise, temporarily mounted as a ring.*

## Richard Hughes FGA, the winner of this year's competition, reveals the story behind his winning photograph, titled 'Going for the Green'.

China's Guangdong province is home to major jade markets in Guangzhou, Pingzhou, Sihui and Yangmei (a 'village' in Jieyang). The latter, near the border with Fujian province, is certainly among the most interesting. In Yangmei, you can quickly feel the wealth brought to the town by the jade trade. Land Cruisers and Range Rovers are the transport of choice, often sporting personalised number plates featuring rows of nines, or better yet, eights, the symbol of luck. And luck is certainly a big part of the jade trade.

Interestingly, the major jade 'auctions' in Yangmei's market take place in the late evenings between nine and midnight. A bag of jade slices is extracted by the owner from the safe, thrown onto a table and all hell breaks loose as buyers scramble to quickly check the quality and then shout out an offer to the owner (see photo). In this manner, an entire lot is dispatched with in a frenzied few minutes. Only those with sharp elbows need apply.

Closer to Guangzhou, the markets of Sihui are also action-packed night-time affairs. Starting at about 3am, a huge market for worked but unfinished (unpolished) jade opens up and runs until about 5am. Then, while still dark, another market for sliced jade scraps kicks in, running until just before sunrise. In this part of China, only early risers get the jade worm. ■

# "Today the prices being fetched by elephant ivory are especially puzzling."

**Gem-A President, Maggie Campbell Pedersen FGA ABIPP, explores how the value of organics is increasingly determined by how they are being sold rather than their innate value.**

An item made from one of the organic materials can be very difficult to value, not least because our trading laws regarding protected species keep changing. Beauty is in the eye of the beholder, so not everyone agrees on the attractiveness of some organics, and with many of them emotions also come into play.

A few years ago I was shown a necklace of Burmese root amber beads. The owner had wanted to sell it, though not at the £30 valuation she had obtained from an auction house. To an amber enthusiast they were beautiful and valuable, but they only came to life if seen by transmitted light which showed up steaks of crimson in the otherwise brown and somewhat dull beads.

Today the prices being fetched by elephant ivory are especially puzzling. Some things sell for almost nothing, while others sell at eye-watering prices. Perhaps some people are showing great caution, knowing that the items will not be saleable in a few months' time, while the real collectors are buying because they know that soon they will not be able to do so and regardless of future values. Many auction houses have stopped trading in ivory, but those that continue are still doing a good trade, and while prices for some pieces of outstanding quality are high, it is at present possible to find some very lovely artefacts for very little money.

Online auctions give another perspective to the situation. For example, the best-known online auction site has very strict policies stating that no ivory or marine turtle shell may be sold, no matter its age, yet it fails to uphold these rules. Ivory and tortoiseshell are sold as 'faux', blatantly contravening the rules, though many things with a known provenance or a silver hallmark proving them to be pre-1947 could at present still be sold legally elsewhere — but elsewhere they realise much lower prices! One such example sold a few weeks ago as 'a glass trinket pot with faux tortoiseshell and silver lid.' The lid very clearly consisted mostly of elephant ivory, inlaid with a small amount of real tortoiseshell. In spite of my reporting the problem to the auctioneers, the sale went ahead some days later, and the pot fetched at least five times what it could have hoped to fetch through a normal auction house.

*This pretty little ivory brooch, probably made at one of the European ivory carving centres in the early 1900's, was destined for the rubbish tip. (Brooch courtesy of BCU.)*

© Maggie Campbell Pedersen.

> "...the best-known online auction site has very strict policies stating that no ivory or marine turtle shell may be sold, no matter its age, yet it fails to uphold these rules."

At the other end of the scale are the charity shops that receive jewellery and trinkets which they believe might possibly be ivory, so, not wishing to sell them, they dump them. The result is that many wonderful little items are finding their way to landfill. There are ideas about what can be done with them rather than losing them forever (some people are kindly donating to teaching centres, which is marvellous), but whichever way we look at it, a variety of very attractive pieces of jewellery are already worthless in monetary terms.

Meanwhile, the online auction house is still selling real ivory and tortoiseshell — and also blue Heliopora coral which is listed on CITES Appendix II. ■

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

**2019 Membership**

# CALLING ALL OUR CURRENT MEMBERS!

## Renew your membership before 31 December and pay just £110.*

**NEW FOR 2019!** We have streamlined and improved our payment systems in order to create a more convenient and secure way to pay your annual membership fee.

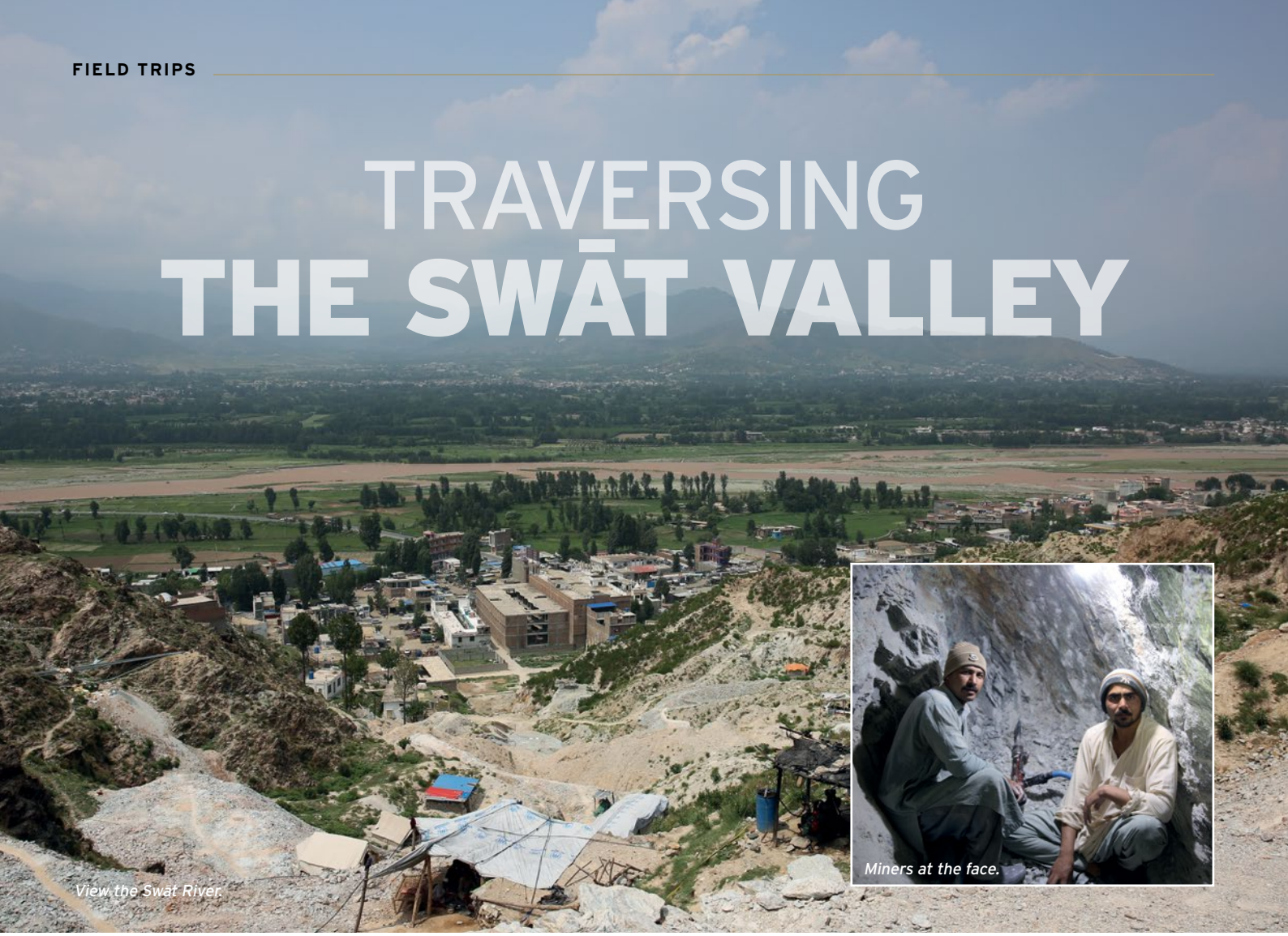
Due to GDPR rules we no longer accept written card details. Instead, we have created a simple online system that allows you to pay by credit or debit card at the click of a button.

**It's easy to do;** just follow the instructions in the 'Renewal Notice' email you received in November and click on 'Pay Now' to visit Sage Pay to renew using your debit or credit card.

If you have not received your email please get in touch with us at membership@gem-a.com

* Any payments after 31 December 2018 will be at the standard annual rate of £135.

# TRAVERSING THE SWĀT VALLEY



View the Swat River.



Miners at the face.

**In July 2018, Gem-A's Charles Evans FGA DGA travelled to the Swāt Valley in Pakistan to explore the region's emerald deposits, invited by The Dragonfly Initiative on behalf of British fine jewellery brand, MYNE London. Here he shares some of the highlights from the trip.**

Recently, the opportunity arose for me to assist an exciting jewellery start-up in a manner that ticked a number of gemmological boxes; travel to an exotic country, visit gem mines and look at gemstones, all with the larger goal of ensuring this bright new name's sourcing commitments can, with absolute confidence, be fulfilled throughout their supply chain.

The women's economic empowerment label is something that is easily misused, largely because it has become a buzzword of sorts. British fine jewellery brand MYNE London can, however, justifiably claim that women's empowerment is a cornerstone of its business model. Its founders Fiona Wellington and Kate Murray-Gordos were determined to put the Swāt Valley emerald on the map with their business venture, thanks in large part to spending a portion of their formative years in Peshawar, Pakistan. Of course, re-introducing the jewellery buying public to the incredible region of Pakistan is no mean feat. There is a need to dispel the negative connotations that recent history has imposed on the province; provide opportunity and inspiration for women in a male dominated society; and, finally, create a product of superlative quality for a discerning and conscientious buyer who can be morally, not just aesthetically, aligned with the brand. To achieve this, MYNE London called upon the jewellery supply chain expertise of The Dragonfly Initiative, a sustainability advisory firm.

Mining shaft.

## ARRIVING IN ISLAMABAD

Islamabad's new airport is very grand, but also very incomplete. Our passage through customs and immigration was pain-free, but the subsequent four-hour wait for

transport served to highlight the paucity of options for refreshment and relaxation.

Although the overnight flight tired us out, it was the six-hour drive to Mingora that filled me with the real 'oh no' moments, largely triggered by the antics of fellow road users. My adrenaline-fuelled eyes-on-stalks permitted a special 'I-am-about-to-die' appreciation of the beautiful passing scenery.

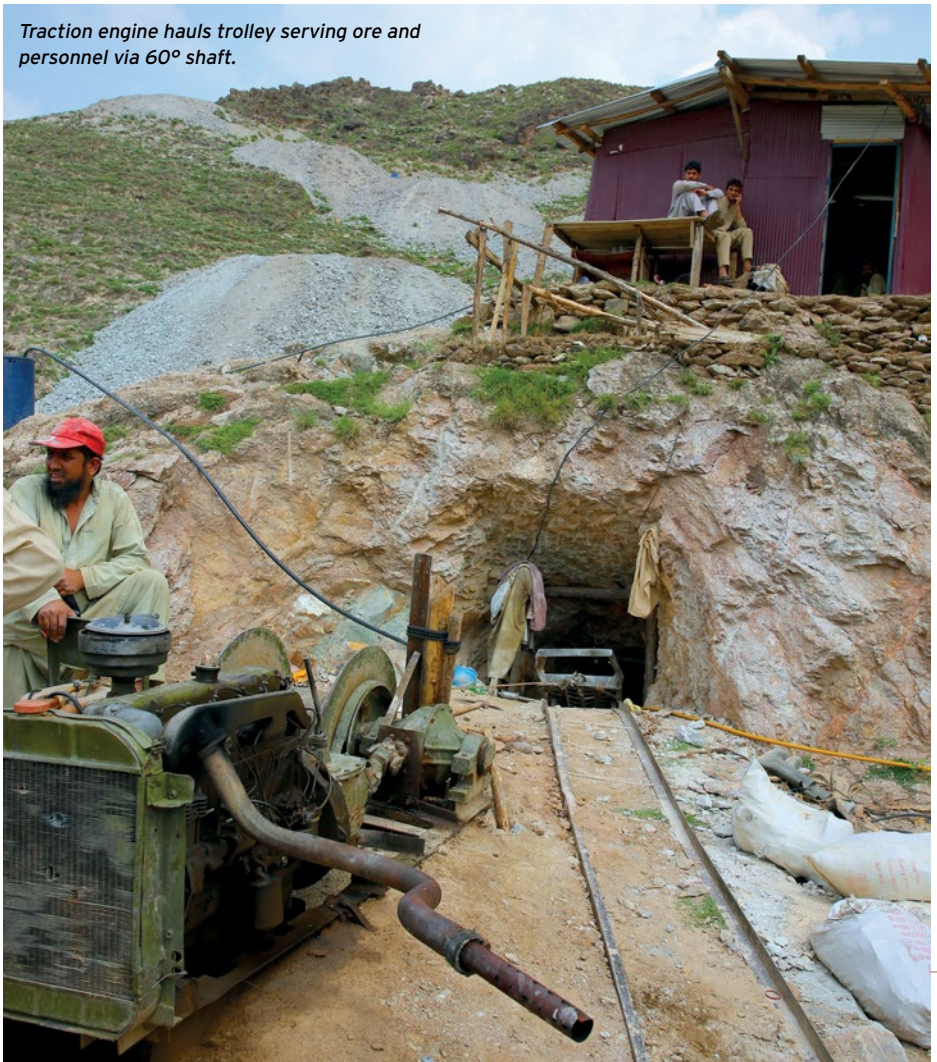
Swāt province is magnificent with soaring mountains and surging rivers. At ground level, the sights and sounds are grittier and no less powerful. Children run unsupervised, oxen and mules pull carts past shops selling computers and mobile phones. Electric hybrid cars weave randomly among Datsuns, handcarts and tractors from the 1960s.

Mingora is the regional capital comfortably nestled between the East bank of the Swāt River and the adjoining hills that are just one of the regions known for famous Swāt Valley emeralds. The next day a short drive would take us up to the mines which overlook the town and river and are all within a couple of kilometres of each other as the crow flies. For those who need a refresh, Swāt Valley, although hundreds of miles from the Afghan border, was a province that spent two years under the iron fist of Taliban rule and life was harsh. Today, sensitivity and caution still need to be applied.

Swāt province is magnificent with soaring mountains and surging rivers. At ground level, the sights and sounds are grittier and no less powerful.

Of course, the region's prouder and more extensive history will overcome its more recent trauma, and ventures like MYNE's are stepping stones in reopening the region to a happier and wealthier future. Ownership of the mines in Swāt is fairly straightforward. There is a single lease that is tendered for (with the existing lease-holder being the preferred bidder) and a transparent system whereby the government can increase the cost of the licence based on macro-economic factors like inflation and the global trade situation. They are also mindful that unrealistic costs would stifle employment and increase illegal mining, which would not be to the ultimate benefit of the government, existing miners or Pakistan as a whole.

It has not been easy to make a success of the Mingora mines. However, a firm, stable and efficient approach to the management of the leases and the mines contained therein has meant that mining has been well received locally and prospects are positive.



*Traction engine hauls trolley serving ore and personnel via 60° shaft.*

## VISITING THE MINES

To my surprise the first of the mines is situated at the top of one of the streets that runs from the hillside and into the town. In fact, the last building in the street forms one of the mine boundaries! This was our first look at a cluster of mines, most of which have incline shafts of between 45 and 60 degrees that run straight down — one we entered is 300 feet long, before lateral shafts penetrate the talc schist to find the tell-tale quartz and calcite veins that typically host emerald.

One mine is orientated on the flat, with access via a wooden door, and with a couple of points in the shaft where a minor chamber of a metre or two in height can be found. Where the terrain and mining permits, a few ventilation points have been created. These allow light and fresh air in from the inside, as trying to create these access points from the outer cliff face would be impossible.

We entered a number of the mines and advanced all the way to the operating face. Working conditions for the miners are some of the best I have ever encountered. Despite no piped air the air quality is good because there is little dust associated with the host rock and none of the shafts are particularly long (most less than 50m). The minimal intrusion of silicates, like quartz, means that exposure to respirable crystalline silica (RCS) and the associated long-terms risks of silicosis is small — considerably less than some of the Western open cast mines I have worked on where masks were considered unnecessary.


*Clipping rough.*

The talc schist was like the mining equivalent of carving a pumpkin. The pneumatic drills used are some of the smallest commercially available for industry, meaning they are light and require no awkward drill stands or blasting for day-to-day operations. Temperatures outside may soar to 40 degrees, but the waxy talc seems to exude a moist coolness that makes the working faces a relatively comfortable environment. There is also little moisture intrusion, either through seepage or by accidental drainage down the access shafts and this means the absence of another mining hazard, flooding. Miners wear PPE like helmets and glasses. Most elect not to wear safety boots, and in fairness, when labour is often conducted in a squatting position and when ore or overburden is in soft, small lumps and is extracted by wheelbarrow or gunny sack, the risk of much worse than a stubbed toe is minor. All the mines have a profit-share agreement on what is recovered. Meals are also provided at some of the mines we visited, and some had hostel-type accommodation and prayer rooms.


*Calcite in talc schist.*

From the hills overlooking Mingora we journeyed to a second mining location. The distance and state of the road precluded a trip into the mine but we got to the entrance of the shaft in torrential rain and could do no more than peer into the gloomy torchlight through the steel bars securing it. Workers have comfortable accommodation and due to the remoteness of the mine enjoy an incredible viewpoint on the side of a hill that overlooks the valley.

A third area where emeralds are classified as Swāt was beyond our reach in the time we had in Pakistan. We drove for a couple of hours to get within a few miles of it, where the road became too challenging for our car. Additionally, we heard that is was either closed or "being run by Chinese owners", but we were not able to verify either of these claims or see any of the product.

## THE EMERALDS

The two most important factors in determining the value of rough emeralds are the colour and the clarity. The perfect colour needs to be a vivid, saturated green, without becoming inky and without the intrusion of a yellow overtone. In Swāt Valley emeralds, the colour and clarity are available, but only in very small quantities and sizes.

The unusual clarity is possible simply because the original crystals are small and coddled between calcite and talc. They are not fragments of bigger crystals as would be the case in emeralds from other parts of the world, they are the plucky survivors whose diminutive size has made their incredible geological journey through time and mountains a safer one. Where the larger stones are highly fractured, the small stones are often inclusion free.


*Large, highly fractured Emerald in calcite at contact zone.*

A third factor in the value of any gemstone is the quality of the cut. Nature spent millions of years making the perfect crystals but fashioning them into gemstones worthy of a place in the most beautiful jewellery is only possible through the most well-equipped lapidary workshop employing the most highly trained lapidaries. The female-majority workforce who cut MYNE's emeralds provide this input, after the comfortingly short journey from mine to cutter.

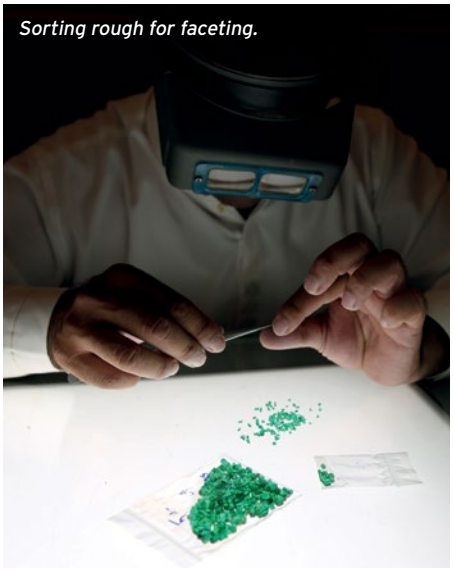
The emeralds are transferred to a modern cutting facility in Islamabad that buys directly from MYNE's supply partner, where we witnessed the next step in the emeralds' journey. Here, with a 80%


Cutting factory in Islamabad.

female workforce, the team specialise in turning the very best of Swāt's small production into the very best of graduated melee between 1.4mm and 2.4mm.

Using sophisticated digital machinery to ensure the level of perfection expected by Europe's finest jewellery houses, the lapidaries elect to specialise and only produce emerald melee. The quality of the small goods from Swāt means that they have no trouble obtaining the raw material to ensure a steady stock of 'Triple-A', inclusion-free melee. With faceters working in pairs, a separate Quality Control area and apprentices in training, every effort is being made to maintain a robust workforce, keeping women in the majority. The finished products are as good as I have ever encountered.

In conclusion, I was staggered by the quality of the Swāt emeralds I saw. Admittedly, it was mostly melee, with larger stones being sold through the cities now known for their coloured stone rough trade, Bangkok and Dubai. The purpose of my visit was to seek assurance that the supply chain is short and clean, and I could confirm that. Swāt filled me with hope that a lovely part of Pakistan will find the recognition it deserves for the quality of its emeralds and far more besides. The kindness and generosity of its people; the deliciousness of its cuisine; the staggering abundance of its agriculture and the incredible beauty of its countryside. ■


Sorting rough for faceting.

All Photo Credits Charles Evans FGA DGA.

MYNE London is a British fine jewellery brand, founded by sisters Fiona Wellington and Kate Murray-Gordos and stands for the empowerment of women in Pakistan's jewellery sector and for peaceful and sustainable development. The brand is founded on the principles of economic (and in particular, female) empowerment; resilience; progressiveness; and glamour. Here, Kate and Fiona talk to Vivien Johnston of The Dragonfly Initiative about their inspirations and plans for the future.

**What was the biggest influence in your decision to source products from Pakistan?**
We lived there as children and were looking for ways to reconnect with the area that we loved in a meaningful and committed way.

**What drew you to the gemstone business?**
Once we realised that there were emerald mines in the Swāt Valley area, which in our opinion is one of the most beautiful places on earth, it was a very easy decision! We are passionate about jewellery and design, especially gemstones, and followed a family tradition from our grandmother and mother of commissioning our own pieces for special occasions.

**What does women's economic empowerment mean to you and why is it so important to your brand?**
The value of equality between women and men cannot be underestimated, and how this positively affects society and relationships. To be equal must include economic empowerment. This is a personal core value to us, so the brand had to have the same ethos.

**What does being a family-owned brand mean to you? Is it fun working with your sister?**
It is really exciting to work together and we can pool our skill sets and resources. There is an ease of communication, and a commitment level that might not otherwise be there. It is extremely fun!

**What is the appeal to consumers of these particular emeralds?**
These emeralds are completely natural, untreated and responsibly sourced. They have a stunning colour that really jumps out in any design.

**What are your plans for MYNE London?**
We are establishing our brand and want to gain a reputation for quality, excellence and beautiful design. We want to be known for our values and ethos. We want to bring positive attention/recognition to the Swāt Valley emerald.

*Pilasters lined with malachite and lapis lazuli, St Isacc's Cathedral, St Petersburg.*

# RUSSIAN WONDERS

## Ever wanted to explore the treasures of Russia? Here, Patricia Campion takes us on a gemmological tour of the Ural Mountains and the cultural dazzles of St Petersburg and Moscow.

Our excursion was planned by eminent Sri Lankan gemmologist Dr Gamini Zoysa and led was by Dr Yuri Shelementiev and Anastasia Prudnikova, both of Moscow State University. Our diverse group was made up of gem and mineral enthusiasts from the US, China, Russia and Europe.

The gemmological highlight of the trip was our stay in the Urals, an area of huge significance for gems and minerals. Based in Yekaterinburg, we visited several local mines, starting with the State owned Malyshev emerald mine. Following the discovery of this deposit in the 1830s, Russia became one of the world's largest emerald producers in the early 20th century, prior to the revolution. Following World War II, the focus switched to the extraction of beryllium for the state nuclear programme; those emeralds not destroyed in this process were relegated to mere bi-products. Emerald mining increased following the end of the Cold War, but the collapse of the Soviet Union again halted operations. Recently, however, the mine has been taken over by Rostec, a state-owned corporation, and production has recommenced.

Originally open cast, mining now is carried out underground. We were unable to view these operations for health and safety reasons (with small quantities of explosives being in regular use), but we toured the administration centre, where a small museum houses a variety of rough samples as well as historic mining equipment. We picked through the waste dump close to the original quarry and saw a mock mineshaft built onsite for training purposes. At the sorting facility, we observed mechanised air pressure sorting, as well as manual sorting where experienced staff scoured the residue for precious stones. Upstairs we witnessed gem grading and saw some beautiful large rough emerald samples and a fine alexandrite crystal.

On our travels through the Urals with local mineral expert Nikolay, we passed a huge asbestos quarry near the eponymous town of Asbest. We visited a local mineral museum showcasing the region's huge variety of minerals. We also visited a local mineral museum showcasing the variety of minerals of the region and fossicked in old quarry sites and on spoil heaps for corundum, beryl, tourmaline, quartz, agate and pyrite. Before we left the area, we saw the collection of the Ural Geological Museum in Yekaterinburg.

Another highlight of our visit to the Urals was our trip to the Korkodin demantoid mine and extraction plant. This is a family-run operation and one of only two licenced commercial producers of this lovely green andradite garnet in Russia today. Discovered in the mid-19th century, demantoid became popular in the royal court of the Tsar and was popular in European Edwardian jewellery after it became a favourite of King Edward VII.

*Training pit, Malyshev mine.*

Outside the Malyshev emerald mine.

Demantoids from this mine tend to be of a darker green colour and may require heat treatment at low temperatures to remove a brownish tint. Those of a more yellow green colour may be prized more highly for their fire, however, all can contain the fibrous horsetail inclusions characteristic of Russian demantoids. At the quarry we saw demantoid veins running through the host rock and were provided with rough samples for inspection. During mining, vast quantities of rock are removed using diggers and are crushed. The crushed rock is initially sorted by gravity sieving and then passed through water to show up the bright green demantoid crystals. Further sorting takes place both mechanically and by sight.

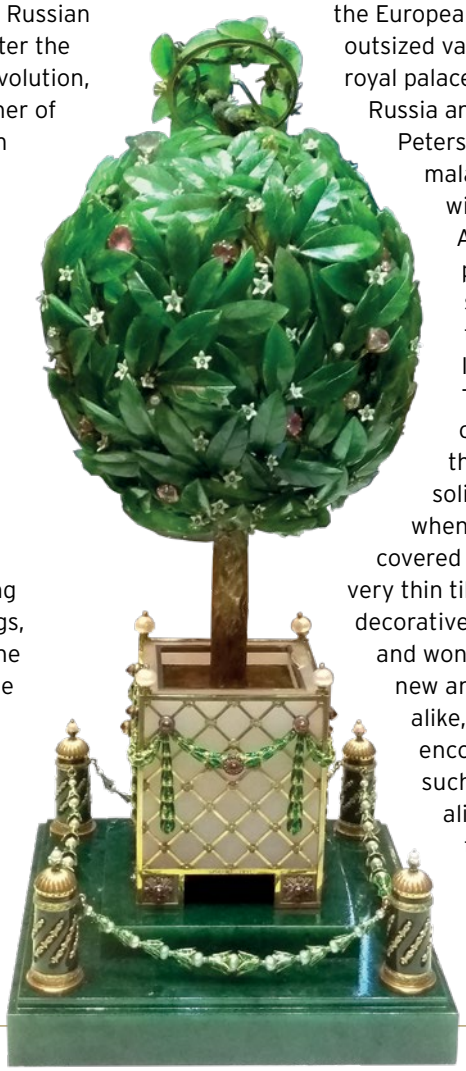
Our itinerary also featured highlights in St Petersburg and Moscow. In St Petersburg, we fully indulged our love of gems with visits to the world-famous Amber Room, the Treasure Gallery at the Hermitage, and the Faberge Museum. The Gold Rooms of the Treasure Gallery contain the wonderous artefacts of the Scythians, and those of Ancient Greece and the Far East. The Diamond Room houses treasures of the Russian imperial family from Peter the Great through to the revolution, and consists of all manner of bejewelled objects, from religious items, sets of horse tack (beautifully studded with Colombian emeralds and sapphires) to a magnificent collection of jewelled walking sticks.

The Faberge Museum at the Shuvalov Palace is the world's largest collection of works by Faberge, with over four thousand items including nine imperial Easter eggs, and personal items of the Romanovs. Clients of the jeweller also included non-elite Russians, but even the simplest items showcase the talents of Faberge's ingenious craftsmen and their glorious enamelling.

*Asbestos quarry, Asbest.*

*Brucite samples including blue Brucite.*

Throughout our trip we were awed by the Russian use of hardstone. A huge top-quality deposit of malachite was discovered in the 1830s in the Demidoff copper mine and was used throughout imperial Russia in the 19th and early 20th century to cover decorative objects, such as vases. These lapidary works of art became highly fashionable among the European elite and many outsized vases still decorate royal palaces throughout Russia and beyond. In St Petersburg we saw this malachite used, along with lapis lazuli from Afghanistan, to line pilasters on either side of the altar of the magnificent St Isaac's Cathedral. These marvellous columns appear to the onlooker to be of solid coloured stone, when in fact they are covered in thousands of very thin tiles. We witnessed decorative use of hardstone and wondrous mosaics on new and old structures alike, and it was encouraging to see such craftsmanship alive and in use throughout modern Russia.



*Imperial Easter egg at the Faberge museum, St Petersburg.*

In Moscow, we were privileged to have a private tour of the world famous Fersman mineralogical museum. Founded in 1716, it was originally based in St Petersburg before moving to Moscow in the 1930s. Today, the museum specialises in Russian minerology but also houses a meteorite collection, a gemstone collection, works by Faberge, and a particularly notable UV display facility.

Our itinerary included a tour of the Kremlin and a visit to the Diamond Fund, which houses the imperial collection of gems, notable nuggets of gold and platinum mined in Russia, and the Russian state jewels including the Imperial Crown of Russia. The exhibition opened in 1967 and highlights include a dazzling collection of rough diamonds, the largest of which, at 342.57 carats is named '26th Congress of the Communist Party of the Soviet Union'. Also on display is the Orlov diamond now mounted in the sceptre of the crown jewels.

To round off our trip, we visited the gem-testing facility of the Moscow State University, where we gained a fascinating insight into their certification process for gemstones.

## ACKNOWLEDGEMENTS

A huge thank you our hosts and organisers for sharing their knowledge of this fascinating country and its treasures. ■

*All images courtesy of the author.*

*A very bright ammolite fragment showing the different layers of aragonite.*

# New Discoveries

*A beautiful example of a full spectrum ammolite.*

**Hidden for millennia, the rainbow colours of ammolite are a relative newcomer to the international gemstone marketplace. Here, Dacques Nini GG shares his experiences of following the St. Mary River in Alberta, Canada, to discover this unusual gem material for himself.**

In our world of gemmology, many of us recognise time as a mysterious clock that serves as a reference of measurement. Understanding the processes of time, along with heat and pressure in gem formation, allows us to imagine the Earth's various stages of development in order to create the gemstones we love.

Rarely, however, do we consider time as a marker for new discoveries that reveal Earth's hidden treasures within our own generation. In fact, the discovery of modern day gemstones as life markers is certainly applicable today. Consider, for example, tanzanite from Tanzania, cobalt and 'Jedi' spinel from Vietnam... when did you first hear of these?

The beautiful gems called ammolites are another example. This gem material comes from fossilised cephalopods, known as ammonites, which lived around 70 million years ago. Ammonite fossils are found on every continent in rock formations that date back 400 million years, but not all provide ammolite.

Ammolite was first discovered 60 miles southeast of Calgary — a land that was once part of a vast ocean basin known as the Pierre Seaway that flowed down through North America to the far reaches of the Gulf of Mexico. The most exceptional ammolites come from southern Alberta's late Cretaceous Bearpaw formation in Calgary. As a Fellow of the Canadian Gemmological Association, I am quite proud of North America's 'newest gemstone' found in my own backyard. I feel that the origins of these fascinating gems deserve attention. I was therefore delighted to go to the mine and see these beautiful creations for myself.

Ammolite was granted official gem status by The World Jewellery Confederation (CIBJO) in 1981. The lustrous iridescence of the gem is due to the microstructure of nacre – numerous aragonite layers also known as mother-of-pearl – which were preserved. Conditions at the time resulted in a perfect combination of minerals, heat, pressure and time enabling the outer nacreous layers to develop and be preserved in shale. This nacre was fossilised and recrystalised, which is what gives ammolite its opalescence. Aragonite layers on ammonites from other locations are either lost or non-developed on most fossils. The only economically viable deposit with preserved opalescence known to man is in Alberta.

Refraction through the stacked layers of aragonite creates light interference, giving colour to fine layers of gem material. An interesting note on these fine layers is that they always order themselves in the same manner as the visible spectrum of ROYGBIV. Red is the colour layer closest to the fossil, yet the blue, indigo and violet colours that extend to the exterior are the most sought after. Ammolite truly is one of nature's rarest gems. Supplies

*First moments in daylight for over 70 million years. This specimen is flat as the cavity never filled in to keep the original shape.*

are extremely limited with only one source for mining. According to Korite International, which mines and supplies 90% of the world's ammolite, current production estimates indicate that high-grade ammolite could be exhausted within the next 20 years.

In pioneering the ammolite industry, Korite International developed its own in-house grading system that has now become the internationally accepted standard. The gems with a full spectrum of colour and the strongest brilliance bring the highest premiums in the market. Ammolite grading consists of six categories:

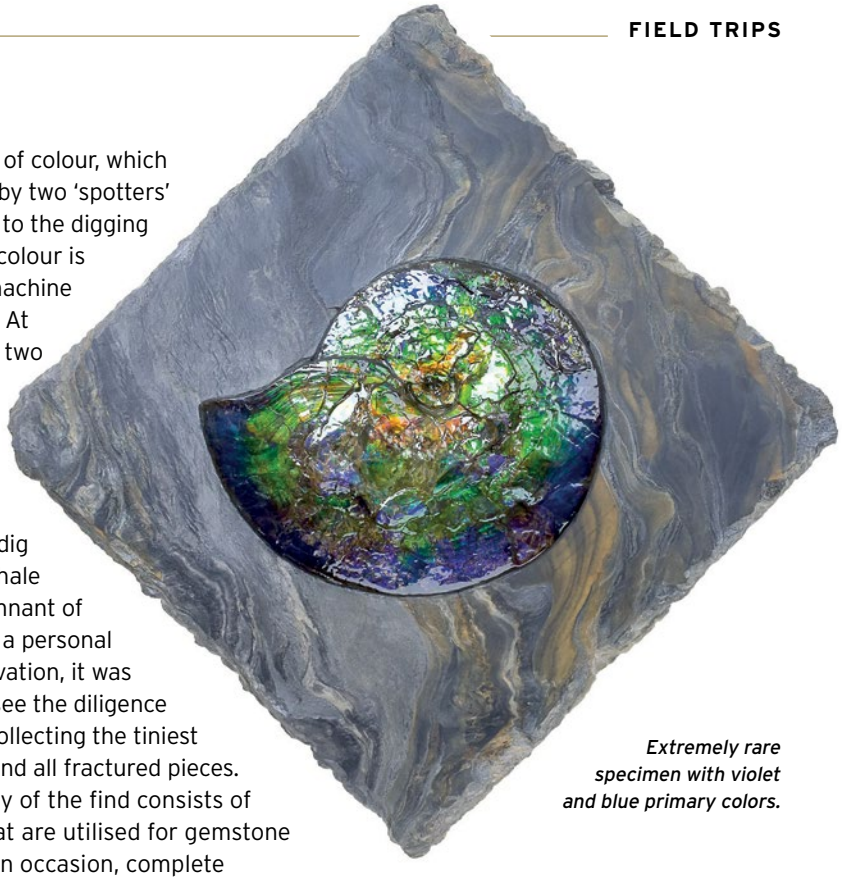
- AAA (exquisite)
- AA (extra fine)
- A (fine)
- Standard
- Fair
- Commercial

Exquisite AAA ammolite displays three or more colours, often displaying full spectrum colour and peak brilliance.

> I AM QUITE PROUD OF NORTH AMERICA'S 'NEWEST GEMSTONE' FOUND IN MY OWN BACKYARD.

Lore about finding ammolites in cliff caves along the St. Mary River is true, but unfortunately the high value reward has left these cliff caves and riverbanks devoid of any further findings. I was privileged to visit where the St. Mary River cuts through the overlying sediments and exposes these coveted fossils just above the water line. The highly sought-after gem material is excavated by heavy machinery in deep open-pit holes close to the river's bank. The overburden deposited on top of the shale containing the gems is often at a depth of 60 feet.

To reach the gem-layer, the excavator operator makes careful manoeuvres. Each movement can potentially reveal tiny glimmers of colour, which are observed by two 'spotters' standing next to the digging bucket. Once colour is exposed, all machine activity stops. At this point, the two spotters and the machine operator go down on all fours and carefully dig through the shale to get any remnant of ammolite. As a personal note of observation, it was incredible to see the diligence they took in collecting the tiniest sliver of any and all fractured pieces.



*Extremely rare specimen with violet and blue primary colors.*

The majority of the find consists of fragments that are utilised for gemstone production. On occasion, complete ammolite specimens are found which vary in thickness. If plant matter and earth materials entered the vacancy of the former animals resting place, the ammolite is thick and wide. Some of the specimens observed were partially filled and therefore flat and fat in different areas. The most treasured ammolites are completely filled and have maintained their original bulbous circular shape.

According to my host John Issa of Canada Fossils Ltd: "Once found, these fossils must be numbered and inspected by the province of Alberta. The provincial inspector looks for anything of scientific importance or some characteristic that is not already represented in the provincial collection. If a specimen is not sequestered by the province, the restoration process can commence."

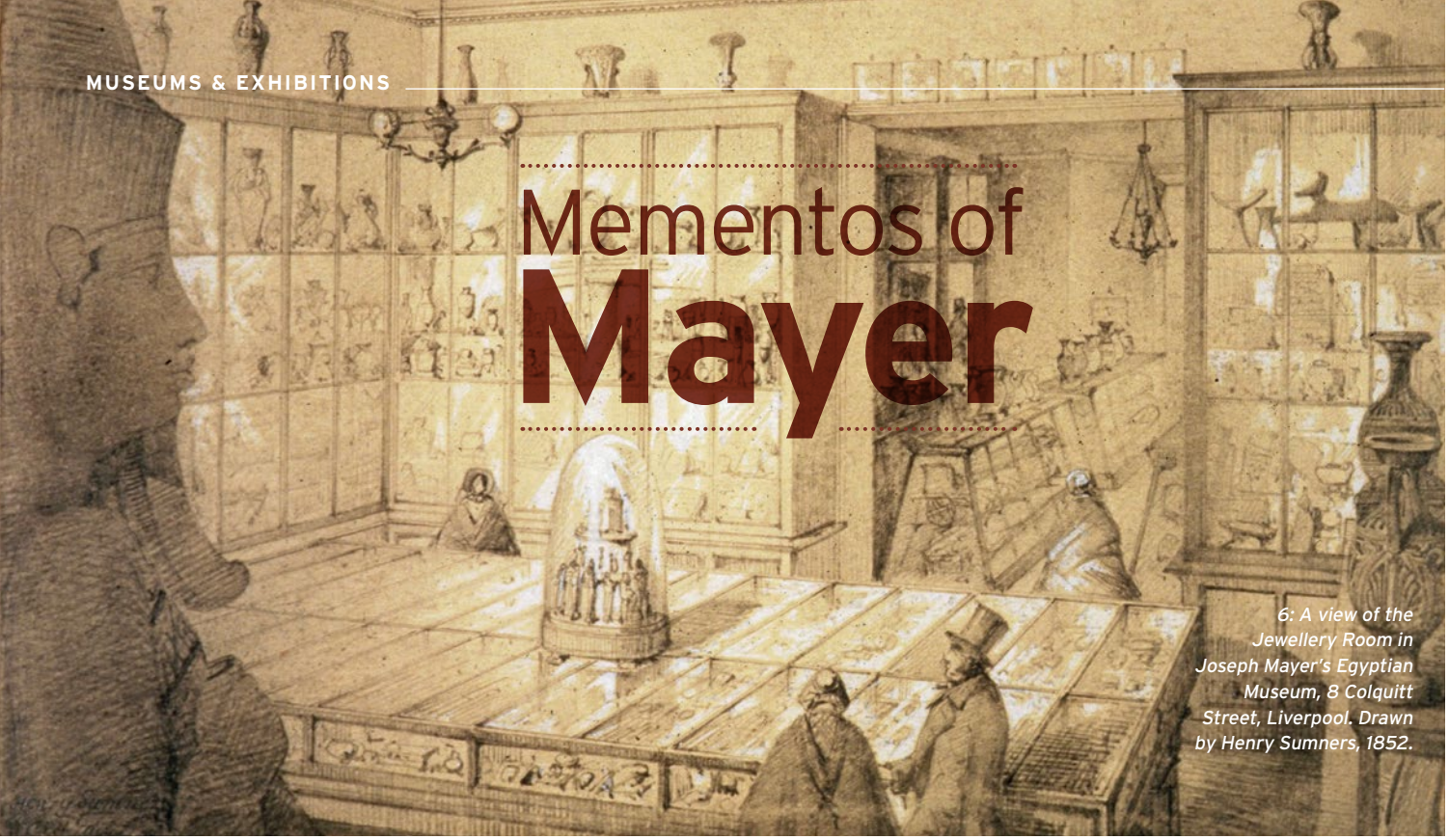
Each specimen whether whole or fractured is then meticulously cared for by an experienced hand. Pneumatic drills are used to remove the shale that has hardened to the spectral colour layer. Further careful polishing begins and is the most sensitive of all processing steps. If the polishing exceeds the necessary depth, the colour can be completely removed leaving the dark undertone of the fossilised ammonite. Upon completion of the polishing techniques, all Canadian ammonites are individually numbered and recorded in the provincial database. A cultural export permit is then required before these precious fossils are allowed to leave the country.

Colourful Canadian ammonites have been sought after by private collectors and public institutions for decades. They are prominently on display in almost every natural history museum in the world. Canadian ammonites are the pinnacle of many private fossil collections. It is rare to find one item that encompasses so much. Ammonite is a fossil, a gemstone and a unique mineral specimen all in one beautiful object. Ammolite from Alberta, Canada, surely stands on its own among the discoveries of the last few decades. ■

*All images courtesy of the author.*

*Walking into the shale banks of the Saint Mary River.*

# Mementos of Mayer



*6: A view of the Jewellery Room in Joseph Mayer's Egyptian Museum, 8 Colquitt Street, Liverpool. Drawn by Henry Sumners, 1852.*

**Drawing on the private collection of jeweller Joseph Mayer, the World Museum in Liverpool houses fascinating gemstones and jewelled objects from a host of ancient cultures. Here, curators at the museum share their insights into some of these unusual treasures.**

## DR CHRISSY PARTHENI, CURATOR OF CLASSICAL ANTIQUITIES ON MAGICAL GEMSTONES

The amazing antiquities collections of World Museum Liverpool owe much to the jeweller Joseph Mayer (1803 – 1886), a keen collector of antiquities. I have recently identified and digitised the magical gemstones from his Roman collections as well as those purchased in 1953 from Dr. Philip Nelson (1872-1952), the Liverpool-born numismatic and antique collector.

Magical gemstones are often categorised as jewellery or as amulets because many would be worn as rings or pendants, but their iconography and function requires specific expertise. Modern archaeologists came up with the term 'magical gemstones' to differentiate them from ordinary gems. The production of magical gemstones started in the late Hellenistic period with a peak in the 2nd and 3rd centuries AD and they were found mainly in the Eastern Mediterranean. They were made in stones such as haematite, cornelian, jasper and lapis lazuli but also in bronze and even glass.

The most intriguing element of these stones is the demonstrable fusion of different ideas and symbols. Take for example this small stone made of chrysoprase, which represents the god Chnoubis: he has the body of a snake and the head of a lion with rays above his head (**1**). Chnoubis was only a minor god of Egyptian astrology and it was probably the makers of magical gemstones who reinvented the god and transformed him into one of the most popular and appealing designs for their diverse clients.

Anguipes, another god often found in many of these stones has the head of a cock, a human body with armour and snaked legs (**2**). He holds in one hand a whip and on the other a shield. The name IAO can often be found with the representation of this god; it is the Greek translation of the Jewish three letter word for god YHW.

The symbols and representations in many of these stones were relevant to their use and intended purpose. For example, the ibis tied next to an altar together with the word πέσσε (meaning 'digest') stood for the power the stone had to help cure or to protect against indigestion (**3**). The uterus, found in many magical gem stones with a key underneath, was a symbol of unlocking fertility or offering protection during childbirth or guaranteed fertility (**4**). Our modern perception of magic may be

*1: A small stone made of chrysoprase, representing the god Chnoubis.*

*2: The god Anguipes with the head of a cock, a human body with armour and snaked legs.*

*3: An ibis tied next to an altar indicates the stone's power to ward off indigestion.*

*4: Gemstones like this one were viewed as talismans to unlock fertility.*

*5: A gemstone carved with words believed to be understood only by the practitioners of magic.*

*7: Gold signet ring, c. 1427 – 1400 BC, inscribed, 'The perfect god, son of Amun, mighty lord'.*

more towards harming or evil and dark forces but in antiquity magic was often a means of offering protection against illness, guaranteeing happiness and love. Many magical gemstones included words or letters, in Greek, but arranged in a way that they did not make any particular sense. These texts are the magicae voces (magical voices) or in other words the formulas that the practitioners of magic used to evoke the power of the stone (**5**).

Magical gem stones in museum displays may be viewed as treasures removed from everyday life. But look closely and you can find signs of human activity all over them: the visible marks of the engravers who created the designs, the magicians who prescribed the magical voices and used them in their practices and finally the owner of the stones, the names of the latter found on the stone with wishes for good health, happiness or fortune.

The sheer quantity of magical gemstones, now about 4,000 known in museums across the world, is proof of their popularity and appeal. The combination of different traditions (Egyptian, Greek, Judaic) in their design speaks for the diverse communities that made up the Roman Empire and makes them a fascinating group of collections for people to discover.

## DR ASHLEY COOKE, SENIOR CURATOR OF ANTIQUITIES ON ANCIENT EGYPTIAN JEWELS

Joseph Mayer opened the Egyptian Museum in 1852 to create a place for those with no opportunity of visiting the British Museum in London. Accommodated within a Georgian terrace house, the museum was filled from top to bottom with Mayer's antiquities and proved an instant success.

Popular with visitors was a large cabinet at the centre of the Jewellery Room, containing 1,682 items within 24 drawers (**6**). Awaiting those that opened drawer three was a magnificent gold ring weighing 38.5 grams, one of the finest examples of a signet ring to survive from ancient Egypt. The swivelling rectangular bezel is inscribed on one side with a cartouche (name-ring) containing the name of Amenhotep II, the seventh pharaoh of the eighteenth dynasty, who ruled between 1428-1397 BC (**7**). Around the cartouche other hieroglyphs describe the pharaoh as the son of Re, divine ruler of Heliopolis (a prime religious centre) and one who fights hundreds of thousands; epithets that stress the pharaoh is a strong ruler and heir of the sun-god Re on earth (**8**).

The 1852 catalogue entry for the ring dated it to the time when Joseph was prime minister of Egypt, a narrative device typical of early museums, making objects more appealing through association to historically significant people and events. The context of four other items of jewellery in Mayer's collection are less questionable, as they still remain on a left hand broken from a mummy — damage that may have occurred long before the mummified part was collected by the Reverend Henry Stobart on his tour of Egypt during the winter of 1854-55 (**9**).

The method of mummification suggests a date around the 1st century AD, a time when Egypt was part of the Roman Empire. During the embalming ritual a layer of very fine linen was applied to the hand, coated with an organic balm which has darkened in appearance over time. An outer layer of gold leaf was applied to the surface, emphasising the divinity of the deceased by making it appear gold, like the skin of the gods. Upon the first and second fingers are gold wire rings with small obelisks of lapis lazuli, with gold apexes and bases. It is no coincidence that the obelisks, a solar symbol, were carved from lapis lazuli, a gemstone with particular symbolism relating to the heavens (**10**). These rare survivals of Egyptian jewellery are without parallel in any other museum collection.

Whilst the gold for these rings could have been mined in Egypt's Eastern Desert or in Nubia (ancient Sudan), lapis lazuli had to be imported from distant lands, such as the region of Badakhshan in north-eastern Afghanistan, making it the most highly prized of all the Egyptians' gemstones. The costly embalming technique was matched by the unique character of the jewellery adorning the body, indicating this person was from an elite family with access to rare resources. ■

*8: Gold signet ring, c. 1427 – 1400 BC, inscribed, 'Amenhotep, son of Re, divine ruler of Heliopolis, the one who fights against hundred thousands'.*

*9: Mummified hand with four rings, c. 1st century AD.*

*10: Obelisk-shaped ring bezels of lapis lazuli with gold apexes and bases with applied wired and granulation, c. 1st century AD.*

*All images courtesy of World Museum, National Museums Liverpool.*

**www.liverpoolmuseums.org.uk/wml/collections/antiquities/roman/magical-gems/index.aspx**

**FREE ENTRY! OPEN DAILY 10AM – 5PM**


*Wallace Chan Presenting to the Gem-A Conference. Photo Credit Alex Herbert.*

# Stars and Stones

**The Gem-A Conference 2018 welcomed gemmology's leading lights to London, with a packed schedule of presentations, workshops and field trips taking place from November 3-6. Here, *Gems&Jewellery* shares the highlights from a memorable long weekend...**

*Jessica Han, Gem-A Head of China, with Keynote Speaker Wallace Chan. Photo Credit Alex Herbert.*

*Gemstone cut by Victor Tuzlukov under light source. Photo Credit Alex Herbert.*

The Gem-A Conference is an opportunity to catch-up with old friends, make new connections and, perhaps most importantly, continue to expand our collective gemmological knowledge. With speakers and delegates hailing from across the globe, the Gem-A Conference is a wonderful reminder of the universality of gemmology, and the many fantastic personalities the field attracts.

The opening day of the Gem-A Conference, on November 3, saw hundreds take their seats in the etc. venues County Hall on the banks of the River Thames. The day was opened in fantastic fashion by **Wallace Chan**, the eminent jeweller, inventor, innovator and perhaps the most patient man in the entire sector! His fascinating insights into a lifetime of precision craftsmanship were extraordinary, with many of his pictures receiving the 'oohs' and 'aahhs' they most certainly deserve.

The second speaker was **Dr Eloïse Gaillou**, whose talk focused on the intricacies of coloured diamonds and the elements (notably nitrogen, hydrogen and boron) that create the various shades. This was then followed by a discussion of the most expensive gems per carat, which only marginally preceded the news of 'The Winston Pink Legacy' — a just-shy-of 19 carat pink diamond that sold for a record $50,375,000 at Christie's Geneva.

*Dinner of the Thames. Photo Credit Henry Mesa.*

**Peter Lyckberg** rounded-out the morning presentations with a focus on the gemstone deposits of Afghanistan and Pakistan, complete with exceptional photos. In case you were wondering, Peter revealed his favourite spot is Haramosh Peak, which, despite being a dangerous landscape, is home to a wonderful group of people.

On Saturday afternoon, **Victor Tuzlukov** showcased his exceptional

*Harold Killingback admiring the Gem-A Photographer of the Year Finalists. Photo Credit Henry Mesa.*

gemstone cutting skills with his presentation. At the end of his talk, the room was well-and-truly dazzled by some of Victor's gemstones, which were placed inside an LED light box to showcase their incredible sparkle. Finally, **Justin Hunter** of J. Hunter Pearls, outlined the incredible work he is doing to preserve, protect and sustain the oceans. The message that the pearl farming industry, which relies so heavily on the health of the ocean, is taking a leadership position in ocean conservation was very encouraging for the future.

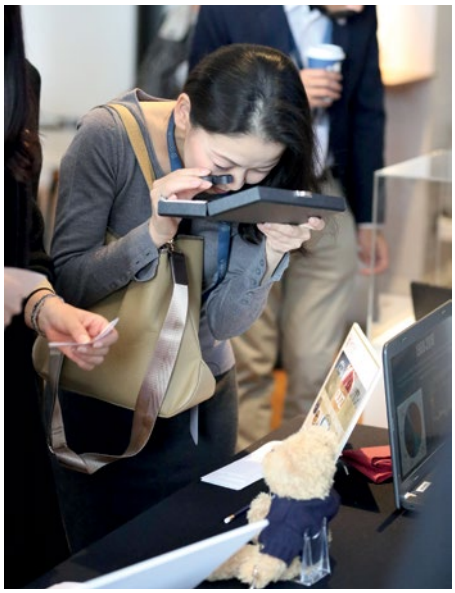
The next 'port of call' was an evening dinner aboard the Elizabethan along the River Thames. Once everyone found their sea legs, delegates were entertained by Gem-A Members Rui Galopim De Carvalho FGA DGA (on vocals) and Hanco Zwaan FGA, who improvised some rather fantastic jazz music!

Our globetrotting gemmological adventure continued on Sunday, November 4, as **Monica Stephenson** shared her insights into tsavorite mines in East Africa. These experiences in the dark, some 500ft below ground, ignited a passion for gemstone origins and led to the creation of ANZA gems — a jewellery business that supports education in Tanzania and Kenya.

Next, delegates were whisked off on a journey to the ruby mines of Mogok by **Federico Barlocher**. He emphasised that Mogok is not just a town: half a million people live there and generations that have spent their lives finding rubies. With 1,200 mines, it is a unique location and there is even a Rubyland FC team in the region! His talk focused on the Dattaw mine and its 400 workers, as well as the lengths, both literally and figuratively of the Kadoke-Tat mine, they have to go to source the finest rubies.

At midday, it was **Dr Jeffrey Post** of the Smithsonian in Washington D.C. who revealed more about the infamous Hope Diamond. It is hard to overstate the impact of the Hope's arrival at the Museum, with its blue beauty and its fascinating history of intrigue, royalty and curses — it generates a curiosity that few other objects can. Attendance to the Smithsonian almost doubled when the Hope arrived, but the most fascinating aspect of having the Hope at the Smithsonian is the research that can be done to model and recast its original shape in the French Crown Jewels. Dr Post's team were able to detect perfect facets, but also bad shallow facets that made no sense. However, when the traditional gold backing was applied, a glorious golden sun shone through surrounded by resplendent blue — which led to the exciting conclusion that this was designed for the Sun King himself, Louis XIV of France.

Next, **Rui Galopim de Carvalho FGA DGA** then took the audience to the depths of the ocean to explore the eco-system of precious coral. Of the 7,000 species of coral, including reef, common and precious, only eight of these are precious coral, and education between the trade and the consumer is key to ensure sustainability and responsible sourcing in the coral industry. Working on CIBJO's Coral Commission, Rui is at the forefront of educating the industry about CITES regulation for protecting precious corals and the exciting initiatives currently being explored to help reforest precious corals — one day we may even have cultured coral!



*Delegate and Diamond Competition. Photo Credit Henry Mesa.*

*Speaker Rui Galopim de Carvalho. Photo Credit Alex Herbert.*

*Saturday Evening on the Thames. Photo Credit Henry Mesa.*

And last, but certainly not least, **Joanna Hardy FGA** finished the day by exploring the history of emeralds – from the desert landscape of Ancient Egypt and Cleopatra's emerald mine, to the Byzantine Empress Theodora bedecked with emeralds. Joanna completed her presentation by showing some exquisite Van Cleef pieces and a radiant Princess Eugenie in the Greville Tiara.

The Gem-A Conference was formally closed by Gem-A president, Maggie Campbell Pedersen FGA ABIPP, who commented on the international nature of the 2018 conference, taking us to so many places, up mountains, to the depths of the earth and sea, and to the exquisite collections in world-renowned museums. Our president finished by thanking the delegates, without whom there would be no conference, and looked forward to seeing everyone in 2019!

On Monday, November 5, we celebrated the 2018 Gem-A Graduation at the Royal Institution of Great Britain. As well as a keynote speech delivered by author, lecturer and broadcaster John Benjamin FGA DGA, the annual Gem-A prize winners were announced, including Zoe Lewis, who secured both the Tully Medal and the Christie's Prize. The 2018 graduates posed proudly with their diplomas in the RI's famous lecture hall before heading to their reception with glasses of bubbles and smiles all-round. ■

*The Gem-A Conference will return to etc. venues County Hall on November 2-3, 2019.*

# THE ULTIMATE JEWELLERY CONNOISSEUR'S WISH LIST

**Are you looking to start, expand upon, or dream about a sparkling designer high-end jewellery collection? Christa Van Eerde MA MLitt FGA DGA discovers the quintessential pieces from the top 10 brands leading the luxury jewellery sector.**

*Cartier Tutti Frutti Necklace. Image courtesy of Cartier.*

## CARTIER

Every jewellery enthusiast desires a Panther or Tutti Frutti piece. The iconic panther is rooted deep within Cartier's heritage, and exudes luxury, elegance and strength. It is hard not to love the faceted diamonds juxtaposed with sleek black onyx. Inspired by Jeanne Toussaint, Cartier's artistic director from 1933 - 1970, the panther was a favourite of the Duchess of Windsor, Wallis Simpson, who wore the figurative pieces, (once the unwritten reserve of the likes of actresses and prostitutes), with bravado and pride.

Bursting with titillating colour, Tutti Frutti provided a welcome step away from the monochromatic styles that dominated the Art Deco period, offering a perfect example of East meets West with its carved gemstones and European technical mastery. Though the iconic style was created in 1901 by Pierre Cartier and remained popular deep into the 1920s, it was not until the 1970s that the style became known as Tutti Frutti.

*Cartier Panthère Bracelet. Image courtesy of Cartier.*

## HARRY WINSTON

Harry Winston, "King of Diamonds," "Jeweller to the Stars…" No photographs of young Harry exist for security reasons, he was always carrying large gems! Some of the most famous stones passed through Winston's hands, including the Jonker, a 726-carat rough diamond he shipped to his New York headquarters through regular registered mail, and the renowned Hope Diamond, a 45.52-carat rare blue diamond, once owned by Louis XIV, Marie Antoinette, and Lord Henry Hope, and now housed in the Smithsonian collection in Washington DC.

Harry Winston and his pioneering designers put the gemstone at the centre of each creation, and did not allow the metal setting to detract from the stone in any way. My ideal piece would encompass Harry Winston's characteristic 'cluster' technique and have the 'Winston Look': timeless, exclusive, and glamorous.

## BULGARI

No collection would be complete without a Bulgari Serpenti bracelet. Bulgari was founded in 1884 by Sotirio Bulgari, a man of Greek heritage who lived in Rome, and the influence of Greek and Roman mythology and culture is highly felt in all Bulgari designs. The serpent has become synonymous with the brand, and represents wisdom, vitality and seduction. The Tubogas technique, which requires no soldering and hides a spring, was inspired by a Roman practise comprising of twine twisted in a decorative manner and allows the supple bejewelled snake to coil around the wrist or nestle on the shoulder. Elizabeth Taylor, a huge Bulgari fan, wore the 1961 version of Serpenti on the movie set of *Cleopatra*. Since then, the Bulgari serpent has continually shed its skin and reinvented itself.

## DAVID WEBB

A David Webb animal bracelet is crave-worthy, particularly if it is a zebra motif, emblematic of the brand. One of the most significant American jewellers, David Webb created pieces featuring the entire animal kingdom; favorites include: frog, monkey, giraffe and elephant. Webb loved antiquity, studied the Incas, and collected objects from Syria, Turkey, Egypt, China and Africa. He said, "I believe the things I make have museum quality and hopefully will last as long as the originals that inspired them". Webb desired to create versatile, textured, and volumetric jewellery which could transition easily from day to night. He had a passion for making the ancient look refreshingly current with bold, geometric, and architectural designs. →

## VAN CLEEF & ARPELS

The dream Van Cleef & Arpels creation for any jewellery aficionado has to be a ballerina brooch incorporating the mystery setting, also known as invisible setting. Patented in 1933, the mystery setting allows stones to magically float, suspended without any evidence of prongs or a mount. As a dancer trains for countless hours to master their art, the mystery setting, which was created prior to contemporary cutting and setting technologies, requires many months to create, so both deserve a round of applause!

Another creation that would be a must-have on the wish list is a Zip necklace, convertible jewellery at its finest (it can be worn as a necklace or bracelet) and a true feat of jewellery engineering. It was first produced in 1950, the result of a challenge from Wallis Simpson to Renée Puissant, the Maison's artistic director and daughter of Alfred Van Cleef, to create a necklace that literally acted like a zip fastener. It remains a distinct stronghold in Van Cleef & Arpels' collection today.

Another creation that would be a must-have on the wish list is a Zip necklace, convertible jewellery at its finest…

*Van Cleef & Arpels Zip Antique necklace in yellow gold, with round diamonds, coral, princess-cut sapphires, rubellite, emerald beads and 16 emerald-cut emeralds of 44.75 carats (from Zambia).*


*Andrew Grima aquamarine ring. Image courtesy of Grima Jewellery.*

*Andrew Grima agate brooch. Image courtesy of Grima Jewellery.*

## GRIMA

Self-taught, Andrew Grima let his imagination run wild with his conversation-starter pieces. Unquestionably one of the greatest jewellery designers of the 20th century, Grima's organic, fantastical yet wearable designs have inspired many. He was a champion of unusual and rough (non-faceted) stones, and used diamonds to accentuate bold pieces rather than take the spotlight. You really need to see and wear a piece to fully appreciate Grima's mastery. Grima boasts many notable fans, names include but are not limited to: HRH Princess Margaret, HRH Princess Anne, Jackie Kennedy Onassis, Ursula Andress, Gwendoline Christie, and Marc Jacobs. HM the Queen often wears a gold, carved ruby and diamond Grima brooch gifted to her by HRH Prince Philip in 1966.

## JAR

JAR stands for Joel Arthur Rosenthal, who said "Everything conspires to make you bigger and more public, my instinct and my radar, my selfishness and arrogance and above all the passion for happiness told me to stay small, stay silent, do what you want to do, don't be seduced, don't be enticed, just get on with it the way you think it should be done".

After working for Bulgari, JAR launched his own Maison on Place Vendôme in Paris in 1978. Notorious for being elusive and maintaining his privacy with a discrete shop that one can only get entrance to through a contact, his vivacious flora and fauna designs inspired by nature cannot help but leave one flabbergasted. He is a master of the pavé technique, a setting that consists of myriad small faceted gemstones set tightly next to one another in platinum or a metal alloy he developed to bring out the intensity of the gemstone's colour. JAR produces approximately 100 pieces a year and his work commands staggering results at auction.

## SUZANNE BELPERRON

Albeit recognisable, Belperron is tricky to collect as she never signed her work and you will have to compete with the likes of Karl Lagerfeld, owner of one of the largest Belperron collections. Belperron worked for Maison René Boivin, under the founder's widow, Jeanne Boivin, until 1932, when she left to become the Artistic and Technical Director of the Maison Bernard Herz. Her creations reveal her deep appreciation and fondness for nature, contain motifs from a range of cultures: African, Cambodian, Celtic, Egyptian, Indian and Mayanin, and typically combine precious stones with hammered gold. Her famous following included Jean Cocteau, Elsa Schiaparelli, The Duke and Duchess of Windsor, Daisy Fellowes, Fred Astaire and Aga Khan. Any piece by Belperron is a moveable feast, from the hand of one of the few women who broke into the world of early 20th century jewellery with a tour de force.

## TIFFANY & CO.

Another essential would have to be a piece by Jean Schlumberger, who began his career as a button and costume jewellery designer for Elsa Schiaparelli. One of only four jewellers Tiffany & Co. has allowed to sign their work (the others are Paloma Picasso, Elsa Peretti and Frank Gehry), Schlumberger's best work is associated with the infamous Tiffany blue box. His poetic and often witty designs feature vibrant colour through the use of gemstones and enamel, and his creatures are animated and magnificent.

## BOUCHERON

Boucheron creates unique pieces exemplifying technical mastery and epitomising creative design. My heart would be set on a Boucheron tiara, of which there are many in HM the Queen's collection and which no collection would be complete without. Just as Tsar Alexander III, Maharajah Sir Bhupinder Singh of Patiala, Riza Shah Pahlevi, Queen Farida of Egypt and Queen Rania of Jordan have thought. Who knows, maybe the infamous and currently lost wave tiara from 1910 inspired by Hokusai's *The Great Wave of Kanagawa* will reveal itself one day. ■

*Boucheron Baïkal necklace. Image courtesy of Boucheron.*

# A Student with Vision

Inspired by her Gemmology Foundation course, Gem-A student Judy Zhang has invented an ingenious tool that is now being supported by Gem-A Instruments. Here, she explains what inspired her invention and how she plans to take it to the next level.

**The history of Gem-A is filled with inventions, including Basil Anderson's Chelsea Colour Filter and Herbert Smith's Refractometer. How does it feel to share this spirit of innovation with your SpectroAid device?**

While I couldn't put myself at their level, I do think the SpectroAid it is a great tool to help learn and practice the observational skills needed to become competent with the spectroscope. So for that I am quite proud of it. It is also exciting to think that I've developed something useful but that I'm still early on in my gemmological career. I guess overall, I feel quite lucky to have had this opportunity. Useful idea, at the right time, in the right place.

**What is the SpectroAid and how does it assist the gemmologist?**

The SpectroAid is a tool that you attach to your light source and onto which you place a gem for testing with a spectroscope. It allows you to easily and efficiently compare the spectra of the light source and the absorption pattern of the gem by moving the stone in and out of the light beam (with a simple twisting motion). An additional feature, which I included with the help of Gem-A Instruments manager and gemmology tutor, Sam Lloyd FGA EG, and Gem-A senior gemmology tutor, Pat Daly FGA EG, is a pinhole attachment for visual optics. Also, try looking through it when using the distance vision technique on the refractometer. It really helps.

**What inspired you to create this ingenious tool?**

Sheer panic! The day we began learning about colour in spectroscopy [Gemmology Foundation], Sam started us off with an easy ruby spectrum. No problems there. I got the emission line in the red and the absorption over yellow all the way to green, so it was hard to miss. A selenium coloured paste was so obvious I wondered why we needed instructions to use the spectroscope in the first place.

Sadly though, the feeling of mastery was very short lived, because with all other stones shown to us that day I couldn't differentiate between spectrum of the torch (what I call the naked spectrum) and the absorption pattern of the stone. By the time I got the BluTack, stone and bulb aligned I couldn't quite remember what the naked spectrum looked like. Vice versa, by the time I peeled off the stone I had forgotten its pattern and didn't know what I was comparing the naked spectrum to.

I spent the next few days stressed and determined to find a more efficient way to use the spectroscope. Eventually, the lightbulb moment came in a restaurant. Where I sketched out the design for the SpectroAid, not on a napkin but on the back of a dinner menu!

*The small but incredibly useful SpectroAid, attached here to a light source, can assist amateur and experienced gemmologists alike.*

**How has studying at Gem-A helped?**

I didn't even know what a spectroscope was before I started Foundation, but once I started developing the SpectroAid for it, everyone at Gem-A has been so supportive. All my tutors have been really enthusiastic, which has kept my motivation going, and they have helped with suggestions on how I could improve the final design. It's really helped to be in the place where I can talk to the best teachers and experts in the field. I really do need to give a big thanks to Sam and Pat. Also, the more I learn on the Gemmology Diploma, the more I want to become better within the field of gemmology. I think having the right tools just makes my life easier and more efficient while working towards that goal.

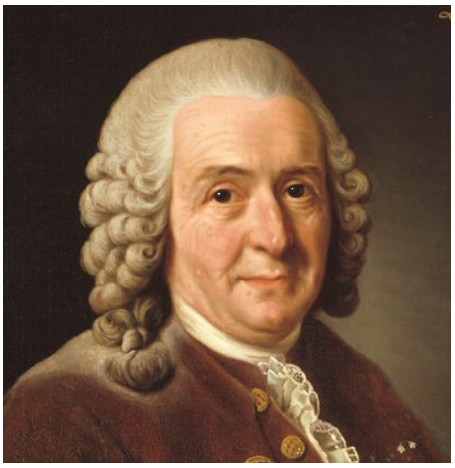
**What is next for you?**

Survive the Gemmology Diploma exams, take a short break, and then work on the Diamond Diploma. In terms of tools and accessories for the gemmologist... let's just say that after my gemmology classmates found themselves with broken conoscopes and dust covered spectroscopes, the cases I designed for those didn't need a sales pitch. Watch this space.

## ABOUT JUDY ZHANG

Judy splits her time and attention between teaching fashion design and studying for her Gemmology Diploma and making the occasional piece of jewellery. She hopes to be able to incorporate her newly-acquired gemmological knowledge into her future work. ■

*The SpectroAid is available to purchase from Gem-A Instruments for £12.50 + VAT. Current Gem-A members and students receive a 10% discount on instruments. If you require any further information, advice or simply wish to make a purchase, please email instruments@gem-a.com.*



# Linnaeus and the Pearls

**Jan Asplund FGA DGA delves into the history and significance of Swedish naturalist, Carolus Linnaeus, whose experiments in pearl cultivation in the early 1740s were truly trailblazing and frustratingly cut short.**

Carolus Linnaeus, or Carl Von Linné, (1707-1778) was a Swedish naturalist whose writings are considered the foundation of modern botanical and zoological nomenclature. Apart from his scientific contributions Linnaeus was also a great collector. Linnaeus described over 800 different spices of molluscs, had more than 3,000 shells in his collection and gave the European pearl river mussel its latin name *margaritifiera*. Linnaeus was quite young when he developed his interest for molluscs, an interest that led him to start experimenting with pearl cultivation in the early 1740s.

During his first year of studying medicine at Lund University, Linnaeus regularly attended lectures on molluscs held by Dr Kilian Stobaeus, the only non-theological professor at the university and at whose house Linnaeus rented a room. After one year at Lund University, Linnaeus moved to Uppsala to continue his medical studies.

After two years in Uppsala, Linnaeus began to offer lectures himself on botany in the university's botanical garden. Word of Linnaeus' talent spread and in 1732 the Uppsala Academy of sciences sent him on a journey to Lapland in the northernmost part of Sweden. Linnaeus was 25 years-old when he made the five month trip alone and on horseback. The journey to Lapland resulted in *Iter Laponicum*, a travel diary with a description of the flora and fauna in northern Sweden.

In *Iter Laponicum* we find some interesting notes on pearl fishing in Sweden in the 1730s. From being perhaps Europe's most important producer of pearls during the 16th and 17th centuries the Swedish production had declined significantly in the late 17th century due to overfishing. Hardly any production was going on anywhere in Sweden at the time of Linnaeus' journey. In several rivers pearl fishing had been banned in an effort to give the pearl mussel population a chance to recover, something that took several decades.

*Linnaeus' drawing of a pearl fishing raft Purkijaur circa. 1730s.*

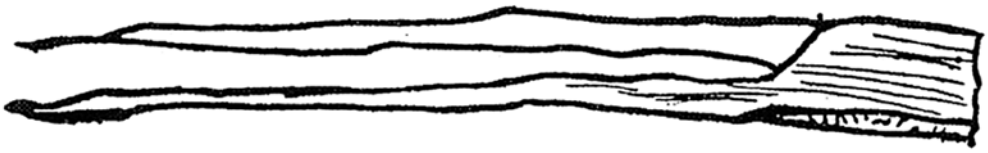
During Linnaeus' visit no one is actively fishing and when Linnaeus asks the locals to show how pearl fishing is done they have to make new equipment to show him.

Linnaeus describes how the fisherman uses a raft that he paddles into the middle of the stream where he uses a branch of birch to tie a rock to use as an anchor. The fisherman lies down on the raft and picks up the mussels from the bottom of the stream by using a wooden fork.

> Linnaeus had... been experimenting with pearl cultivation since at least 1742.

The mussels were opened with a knife to look for pearls, a process that killed the mussel. Out of 1,000 mussels on average only one pearl of gem quality could be discovered. Linnaeus described the process as both uneconomic and thoughtless.

In 1746, Linnaeus was asked to write on the subject of pearl fishing with the purpose of increasing pearl fishing and making it more efficient. Surprisingly he declined and instead referred to earlier works by Erik Benzelius and others. Perhaps instead he wanted to present the outcome of his secret experiments on artificially growing pearls? Linnaeus had, without anyone's knowledge, been experimenting with pearl cultivation since at least 1742.



*End of the fork used for picking mussels in Purkijaur, taken from Linnaeus' own documentation in the 1730s.*

Linnaeus knew about the method used in China to produce blister pearls by placing objects on the inside of mussel shells and then picking them up after a few years when covered by nacre. He even had several Chinese shells containing cultured blister pearls in his collection.

Linnaeus used duck mussels, *Anodonta anantina*, a species belonging to the *Unionoida* family for his experiments. The reason he did not use the mussels that produced the best pearls, the river pearl mussel, *margaritifiera margaritifiera*, was simply that they did not exist in the river Fyrisån in Uppsala where Linnaeus lived and worked.

Linnaeus kept his experiments secret for at least six years until 1748, when he shared his progress in letters to Carl Hårleman and the Swiss naturalist Albrecht von Haller. It was in a lecture in 1748 that Linnaeus gave his view on how pearls are formed. He described how a small worm or parasite could enter the mussel by making a hole through the shell. According to Linnaeus, the parasite then lays an egg inside the mussel and with time the egg is coated with many thin layers of nacre and eventually turns into a pearl.

Linnaeus theory was quite different from the most widely accepted theory at the time; that pearls are the mussel's own eggs. Linneaus also debunked an old myth that it was possible to see if a mussel contained a pearl from the shape of its shell; more bumps and pits were not necessarily a sign that a mussel contained a pearl. Interestingly, he contradicts himself a few years later by in 1740 stating that a man with the right knowledge can see from the outside if a mussel contains a pearl. Linnaeus does not tell what the clues to look for are but continues by stating that if the fisherman knows this he will avoid "killing thousands of mothers," highlighting his concerns about overfishing and the risk of extinction.

Linnaeus describes the process to culture pearls as very easy and simple. During his experiments he drilled a small hole through the shell and secured the bead with a thin silver wire. Linnaeus used limestone and gypsum for the beads. The simplicity of the process concerned him because if the method of culturing pearls was going to be of any economic importance to Sweden, then it had to be kept secret and only known by people involved in production.

One of his greatest concerns was that the method would spread to Norway, which then belonged to Sweden's arch enemy Denmark and Russia (both places had larger mussel populations than Sweden). In one of his letters Linnaeus feared that people may find a prepared mussel by-chance, or could get a worker drunk to learn the process.

*The collection of Linnaeus' pearls, now housed at The Linnaean Society of London. Image courtesy of The Linnaean Society of London.*

This encouraged him to propose Purkijaur, the same place he visited in the far north of Sweden in the 1730s, as the perfect place for production. He also suggested putting the mussels in cages made out of steel wire to make it easier to relocate them when the pearls had grown large enough. According to Linnaeus, it took six years for a pearl to grow as large as a pea and after 12 years its size would have doubled.

A businessman and member of the Swedish Chamber of Commerce, Ehregott Nicholaus Bagge, bought the rights to Linnaeus' method in 1762 on the condition that 50% of future profits would belong to the crown. Bagge also acquired nine pearls and six mussel shells from Linnaeus' production. Due to poor health and many other obligations, Bagge never started any pearl production and after his death the documentation and the pearls were considered lost. The documents and the pearls from Linnaeus production were later found in a sealed parcel by Bagge's grandson Jacob Bagge in 1820. Bagges grandson tried to sell the rights to the production but could not find a buyer (probably because of the high price he demanded).

One of the people Jacob Bagge approached was the English botanist and founder of The Linnaean Society of London, Sir James Smith (its name was directly inspired by Linnaeus who died in 1778). Smith declined the offer from Bagge in an 1821 letter, stating: "The only *pearls* I ever expected from the possession of your illustrious countryman's literary treasures are *pearls of science*..." He ends the letter by stating: "I have no intention of carrying out the scheme — still less paying £500 for any further information..."

Eventually, in 1871 Bagges great-great-grandson, Oscar Dickson, donated the documentation, pearls and shells to The Linnaean Society of London where they are still kept today. ■

*A full list of references is available upon request.*

*A bird's eye view of Oxford University. Photo by Photo by Sidharth Bhatia on Unsplash.*

# HELD ALOFT THE RING

**Many of the finger rings amassed by 19th century art collector, historian and University of Oxford benefactor, C.D.E. Fortnum, can now be discovered at the Ashmolean Museum in Oxford. Gem-A tutor, Beth West FGA DGA EG, explains why she is revisiting the collection with fresh eyes.**

There were two men named Checco in Rome. The first was an elderly porter at the Villa Massimo. He knew all the *condatini* (peasants) working the fields and, in turn, any jewel they had unearthed, buying them cheap. The second Checco was a tobacconist in the Piazza Barberini. Those workers would offer him their finds in return for a smoke. These two Checco's made quite the pretty penny from the wide-eyed collectors of the late 19th century, and there is little doubt that among them, dancing hastily from dealer to dealer in the markets of Rome, was Charles Drury Edward Fortnum.

C.D.E. Fortnum was born in March 1820 and sat within the complex family tree of the celebrated grocers, Fortnum & Mason — an accolade he shied away from. He married his cousin, Fanny Keats, in 1848 securing a good portion of his wife's fortune, which she had acquired through a recent inheritance. With this money, the pair travelled, spending the winters on the south coast of France, the summers in the Tyrol, and numerous other European cities. But it was Rome, the Eternal City, which was their favourite.

*The intriguing 'fine sapphire ring' that forms part of the Fortnum collection at the Ashmolean Museum in Oxford.*

Antiquarianism was the gentlemanly pursuit of the well-connected. It was the careful and rigorous study of physical evidence to further illuminate and understand the past. It was considered a science, a scrutiny of empirical fact, and in the early Victorian era it had very much found its footing. The Society of Antiquaries in London, although founded in 1707, was now beginning to blossom, birthing new areas of specialism, such as numismatics and archaeology. The study had extended beyond the 'man of tastes' obsession with Classical Greece and Rome, to embrace all civilisations and periods, and the artefacts of the past, large or small, were a new site of exploration.

## A NEW ERA IN ENGLAND

During the 19th century, the earth had turned, literally. In the wake of the agrarian revolution, the building of railways and the extension of roads, the dormant treasures of the past were being churned to the surface in the fields across Europe.

But it was the smallest pieces that captured the imagination of Fortnum:

rings that had been lost, thrown or buried. Fortnum saw these miniature works of art as important cultural documents and they became the centre of his collecting pursuits. In fact, he referred to his finger rings as his "dolls and babies".

In 1897 in honour of Queen Victoria's Diamond Jubilee, Fortnum gifted 828 pieces from his collection to the Ashmolean Museum, Oxford. This donation elevated the University Museum's collection of finger-rings up to the third most important in England, behind those of the Victoria and Albert Museum and the British Museum.

Crafted by Fortnum's dedication to his subject, it is the scope of the collection that lends it such significance. Fortnum was conscious that he had to span every age of ring making for his purchases to be academically meaningful. As a result, he created a trove spanning millennia, with the earliest ring dated to ancient Egypt and the latest to the late 19th century.

## ENTER THE EAGER GEMMOLOGIST

Ten years ago, I had the honour of curating this collection of finger-rings for the new galleries in the Ashmolean Museum. Now, as a gemmology tutor at Gem-A, my thoughts returned to Fortnum's collection and how I could create a collaborative project to cast a gemmologist's eye over some of the rings.

Because a large proportion of the pieces have not required adaption or conservation since their acquisition, they offer us a direct insight into the quality of the material available to the collectors of the late 19th century. When considering items in the collection from a gemmologist's perspective, one piece in particular is intriguing.

It is referenced as a 'fine sapphire ring', with a gold openwork hoop interspersed with three knots of Hercules enclosing stars, measuring 17.93mm internal diameter and weighing 7.78gms. This ring forms part of a treasure known as the Chalcis Hoard — a group of objects discovered in 1840 on the Greek Island of Negroponte (Euboea) in the fortress and harbour town of Chalcis, an auspicious trading port for the Venetian maritime empire. Purportedly discovered in the Castle, the hoard, in the most part, consists of decorative gem-set

> This donation elevated the University Museum's collection of finger-rings up to the third most important in England...

rings reflective of the courtly life of the inhabitants. It was believed to have been hidden from the impending threat of the Turks prior to their invasion in 1470.

Fortnum purchased 21 of these rings in 1860, and he considered it one of his finest achievements. The majority of the rings are of excellent quality, including a selection of unusual high-bezelled rings, each set with a dance of pearls pearls; a deep ruby cabochon ring supported with finely-modelled dragon shoulders; a selection of Venetian signet rings, most set with ancient intaglios, and numerous others. In comparison, the 'fine sapphire' of our study seemed to fall a little short.

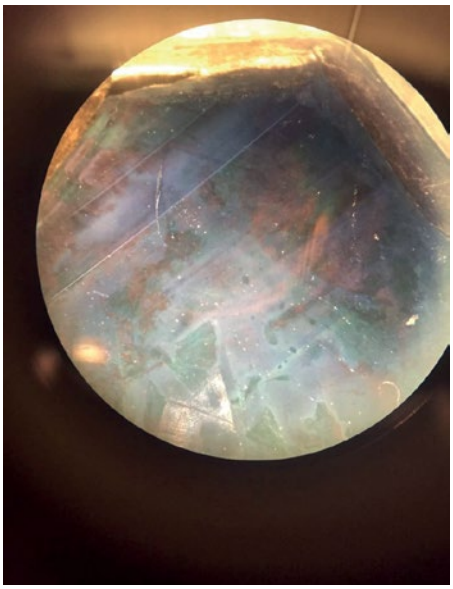
The gem is set deep within the bezel, meaning that standard gemmological analysis was limited to observation. Under magnification, fine acicular rutile could be seen intersecting at 60/120 degrees and there was notable hexagonal zoning. Both of these features are indicative of corundum, variety sapphire. But the stone appears to be little more than a fine slice, as the adhesive is very obvious directly below the table. The inferior quality of the ring is in striking contrast to the other Chalcis rings, particularly considering the presumed affluent origin of the hoard.

Chalcis was an important trading centre, central between Venice and Constantinople, and would have had access to the finest stones coming in from the East, including sapphires from Sri Lanka. The ring is dated as fifteenth century, contemporary with the Venetian reign, and the majesty of the shank would suggest that it was worthy of a superior stone — not dissimilar to other sapphires in the Chalcis Hoard.

So, could this be a crude repair or has this stone been replaced — once the seat of an ancient intaglio or a larger stone? Or is this a 19th century forgery thrown in for good measure to boost the price of the group to fool our unsuspecting enthusiast?

These are all questions that I am accumulating through my on-going research into the gems in this collection. I look forward to sharing any further insights with you as I progress. ■

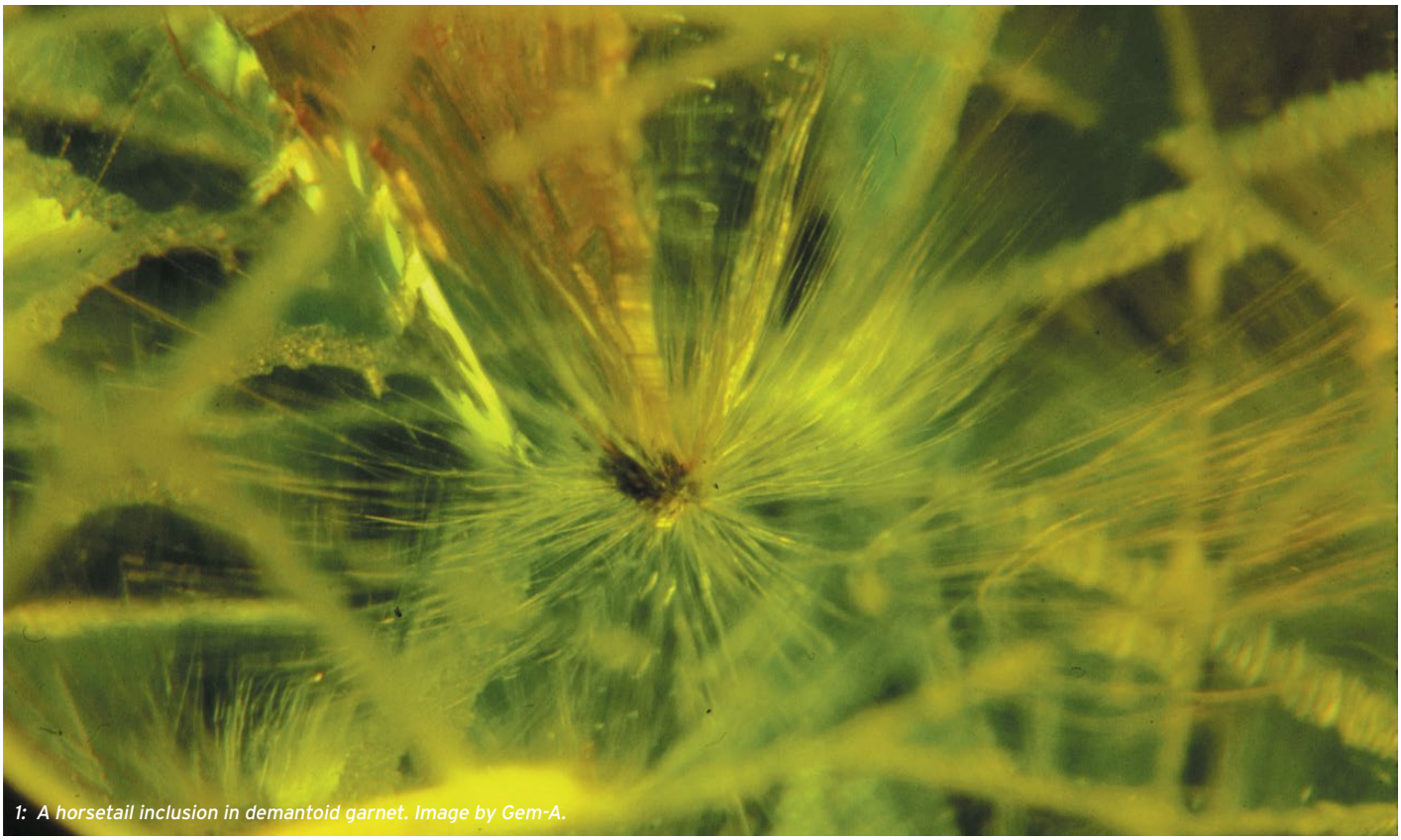
*The ring was examined and photographed by Beth West FGA DGA with kind permission of the Ashmolean Museum.*



***The sapphire ring under 50x magnification, detailing the hexagonal zoning in the slice of natural stone (with the obvious adhesive layer beneath).***

# Beyond 'Horse Tails' in Demantoid Garnet

Gem-A Gemmology Diploma graduate Zoe Lewis FGA has had a particularly exciting year, winning both the Christie's Prize for Gemmology and the Tully Medal for her exceptional exam papers. Here, we've called on Zoe one more time to reproduce a condensed version of her Diploma project focusing on the unique characteristics of demantoid garnets.



*1: A horsetail inclusion in demantoid garnet. Image by Gem-A.*

Demantoid is the green variety of andradite garnet. According to the information to be found in general gemmology textbooks, it is coloured by chromium, obtained from Russia and contains diagnostic 'horse-tail' type inclusions (**1**).

Since demantoid was discovered in the Ural Mountains in the mid-nineteenth century and right up until the 1990s, the gem was known in significant quantities solely from that location. However, over the last 20-years a flurry of new discoveries has brought more localities to the market and with them an increased variety of colour-range, composition and inclusions.

A survey of journal articles soon reveals this more complex picture: stones from various new sources with differing chromium contents and quite distinctive inclusion landscapes. It further becomes evident that demantoid may vary in predictable ways by location and this raises the question whether, if the data can be collated and organised, we might be able to suggest the locality of a demantoid by analysing its composition and inclusions.

## SAMPLES AND METHODS

The addition of new sources for demantoid has promoted the need for new thinking on how we recognise and identify this gemstone. As Aaron Palke and Vincent Pardieu state, it is now possible that "demantoid garnet can be broadly divided into two petrogenetic groups, namely skarn-hosted and serpentinite-hosted", each with its own distinctive characteristics (Palke and Pardieu, 2014 ). Traditional sources such as the Ural Mountains in Russia are serpentinite-hosted, while newer

*2: Namibian demantoid garnet in rough and polished form. Photograph by Henry Mesa.*

mines such as those in Namibia and Madagascar are skarn-hosted. The serpentinite deposits formed through regional metamorphism while the skarn deposits were formed through contact metamorphism. (**2**)

Several studies have been carried out to catalogue the characteristics of demantoid samples from various locations, although each focuses on an individual locality and do not bring together the information into a comparative study. In addition to standard gemmological testing and observation, many of the samples underwent electron microprobe analysis to identify individual mineral inclusions, with some authors utilising Raman spectrometry for the same purpose. Both of these techniques can focus on tiny inclusions, working at extremely high magnification. Raman spectroscopy analyses the characteristic re-emission of energy (Raman spectrum) of a material when excited by higher energy, commonly by focusing a laser upon the material and detecting the slight difference in the energy re-emitted.

Electron microprobe analysis was also used to determine the chemical composition of the samples, with more detailed data on the presence of trace elements ascertained from laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). This is a relatively recently developed technique that analyses elemental composition. The laser burns a tiny hole in the sample, releasing a small amount of matter. The inductively coupled plasma (ICP) source then converts the released atoms into ions that can be assessed by the mass spectrometer to determine their identity.

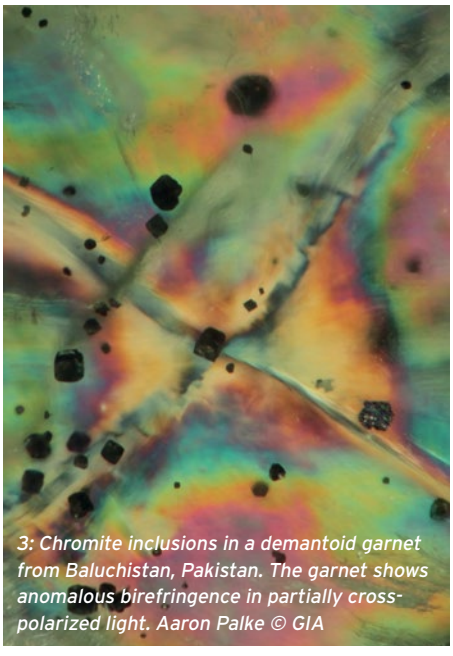
The standard gemmological properties of the samples were found to be reasonably consistent across the different locations. The stones are repeatedly described as green to yellowish-green in colour, transparent, isotropic with varying levels of anomalous birefringence due to strain, refractive index greater than 1.797, specific gravity between 3.80 and 3.90 and inert to ultraviolet radiation. Differences between the locations were noted in two principal areas: trace elements in the composition and types of inclusions. I will therefore focus my investigation upon these two aspects.

## COMPOSITIONAL VARIATIONS

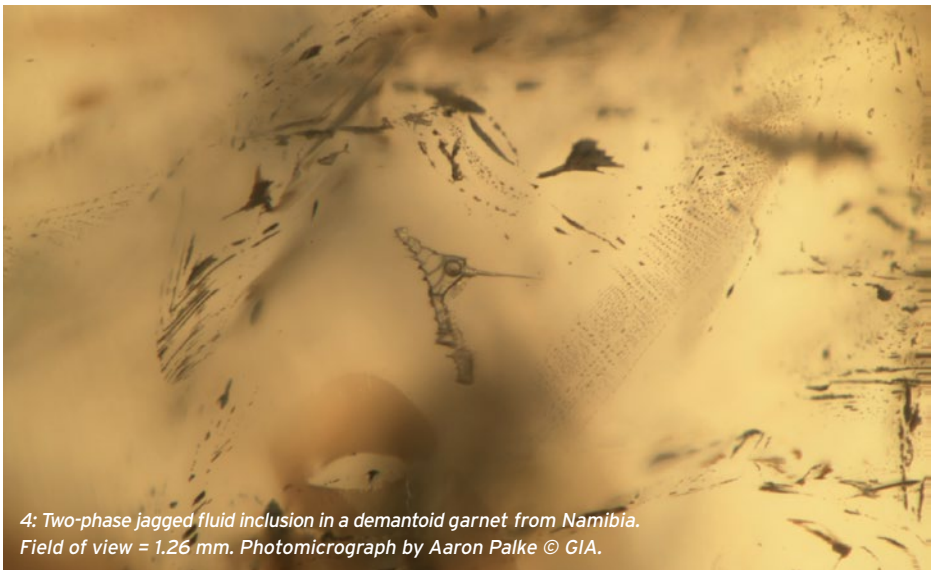
All samples were found to be composed of almost pure andradite, typically 96-98%. Members of the garnet family are almost universally a mixture of more than one type due to extensive isomorphous replacement. Demantoid is therefore unusual in being almost purely of a single type. Stephan Reif, in his description of Namibian demantoid, states that andradite generally contains significant amounts of grossular garnet, but that the green stones regarded as demantoid are characteristically close to being pure andradite (Reif, 2017). In their analysis of Madagascan material, Pezzotta e*t al* found that the surrounding garnet grains contained higher levels of grossular in their composition compared to the demantoid crystals analysed which were almost pure andradite (Pezzotta, 2011).

Demantoid is commonly described as the chromium-bearing variety of andradite, with that element playing a significant role in producing the gemstone's distinctive green colour. Across most of the samples analysed, chromium content was in fact found to be negligible; in samples from Madagascar, Mexico and Pakistan it was below the limit for detection by the electron microprobe. In these instances, the green colour was attributed to iron content inherent in the garnet's composition. Interestingly, in the stones from Pakistan and Italy, the chromium content was mapped and was found to be largely related to chromium-rich magnetite inclusions in the samples, rather than being part of the composition of the demantoid itself (**3**). Chromium concentration was highest adjacent to these inclusions and significantly diminished further away from them. It strikes me that this is a finding worthy of further investigation, and it renders it logical that overall chromium content should be so negligible in demantoids that don't feature these inclusions, such as the skarn-hosted stones of Madagascar and Namibia.

It is maintained that the purer, more intense greens of fine Russian demantoids are enhanced by chromium, although Mikhail Ostrooumov reminds us that not all Russian stones do have a significant chromium content (Ostrooumov, 2015). Namibian demantoid is regarded as having a more subdued colour because of its lack of chromium, although it is possible to obtain fine specimens from this location. Demantoid from Italy, a historical source that has produced little facetable material, has varied chromium content, and it is a matter of debate what impact its presence has on the colour. The earlier study, by Paul Hoskin *et al*, considers the intensity of the green colour in the



*3: Chromite inclusions in a demantoid garnet from Baluchistan, Pakistan. The garnet shows anomalous birefringence in partially cross-polarized light. Aaron Palke © GIA*



*4: Two-phase jagged fluid inclusion in a demantoid garnet from Namibia. Field of view = 1.26 mm. Photomicrograph by Aaron Palke © GIA.*

samples to be related to the prevalence of 'horse-tail' inclusions, which are green, with those stones that contain the most inclusions also having the most intense colour. The authors see no correlation between the chromium content and colour. The later study by Ilaria Adamo *et al* takes a different view, establishing a correlation between higher intensity of colour and increased chromium content in their samples, although chromium content was noted as being in relatively low concentrations overall. Which theory is correct requires additional research and is outside the scope of this report, but overall, it becomes clear that chromium is not a necessary chromophore in demantoid, the colour mostly being produced by intrinsic iron.

As we have seen, across a variety of sources chromium is either almost or completely absent from the demantoid's composition, and it is worth considering the impact this has on the absorption spectrum observed. The 'typical' absorption spectrum of demantoid is given in DeeDee Cunningham's *Practical Gemmology* as "a cut-off at 443nm, a doublet in the deep red at 701nm and weaker lines at 693nm, 640nm and 621nm", but the picture is much more complex than this. In general, the spectrum will almost always contain a ferric iron band at 443nm, or a cut-off at this point marking the beginning of general absorption of the violet, although in some cases the general absorption may extend further than 443nm, perhaps as far as 520nm16. Further areas of absorption due to iron may also be seen, such as a broad band around 600nm reported in the Madagascan samples (Pezzotta *et al*, 2011).

Bands in the red area of the spectrum and the well-known doublet in the deep red, caused by chromium, are absent from many demantoids, and are most likely to be observed in stones from Russia or Italy, where chromium content is of more significance. When chromium features are present the absorption spectrum can be very helpful in identifying a stone as demantoid, but since stones may often have little or no chromium content, care is required: in samples where only the iron features are present, the spectrum may appear to be very similar to that of chrysoberyl, which may also be of similar colour. In terms of the determination of location, the level of variation in chromium content across all sources means that this feature is of little assistance.

## INCLUSION VARIATIONS

The samples also demonstrate that demantoids from different geological origins vary significantly in the inclusions they possess, with some inclusion types highly characteristic and limited to only one deposit type. Closer investigation further suggests that there is variation in inclusions between different localities with similar geological origin, providing an additional narrowing down of the possibilities and allowing a more specific suggestion of locality.

Some inclusion types are observed in demantoids from all or most sources. Small fractures, sometimes partially healed with either liquid or solid materials and having the appearance of 'fingerprints', are not particular to a specific locale, being documented in samples from Namibia, Madagascar and Italy. Similarly, growth or colour zoning, usually straight and angular, is seen in several localities including Italy, although it would appear to be both less prevalent and less prominent in stones from that location in comparison to those from Namibia and Madagascar, where it can produce a dramatic multicolour effect.

Fluid inclusions, sometimes appearing as 'veil-like', and two-phase inclusions featuring liquid and gas components are also observed. Such inclusions are very prevalent in Madagascan demantoid, and similar inclusions have been reported in Namibian material, which was formed in a similar way (**4**). They are not documented in the samples from serpentinite deposits, which formed through regional metamorphism, and they can therefore be considered as indicative of a stone's skarn-hosted origin.

*Table 1: Inclusions in demantoid by locality.*

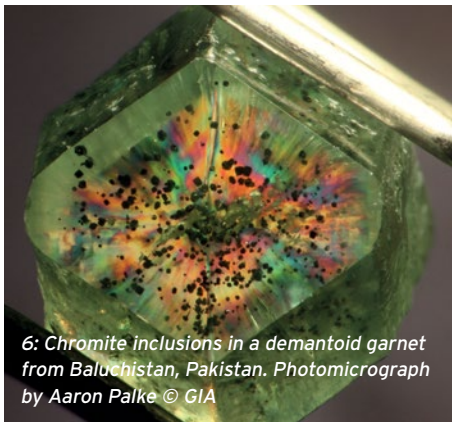
| Locality | Typical Inclusions |
|---|---|
| Italy | 'Horse-tails' – radiating masses of chrysotile fibres with central chromite crystal, fractures (sometimes healed), straight growth lines, white crystal inclusions, dark magnetite inclusions |
| Madagascar | Colour zoning, fluid inclusions, fractures (may be partially healed – 'fingerprints'), growth tubes, diopside aggregates, wollastonite needles or hollow channels |
| Namibia | Pronounced colour-zoning, fluid inclusions, negative crystals, two-phase inclusions, circular stress fractures, mineral inclusions – diopside, wollastonite, quartz, calcite, sphalerite |
| Pakistan (Balochistan) | 'Horse-tails', black magnetite crystals, opaque white masses of serpentine-group minerals |
| Russia | 'Horse-tails', diopside needles or hollow tubes |

*5: Horse tail inclusions in demantoid garnet. Photomicrographs courtesy of E. Billie Hughes of Lotus Gemology.*

It is in mineral inclusions that the most variety is observed. That most closely associated with demantoid is the 'horse-tail' formation of fibrous, crystalline inclusions of chrysotile, a serpentine mineral (**5**). Originally described as byssolite fibres, advanced testing techniques and equipment, such as the electron microprobe, allow these inclusions to now be correctly identified as chrysotile-serpentine. These inclusions often feature a black chromite crystal as their nucleation point and radiate outwards in a characteristic formation, reminiscent of a horse's tail. These are diagnostic for demantoid where present, and are traditionally regarded as strongly suggestive of Russian origin; almost all Russian stones contain them. Analysis of the samples shows that such inclusions are invariably present in stones which originate from any serpentinite deposit (all the Russian and Italian samples contained these inclusions and nearly all the stones from Pakistan) and are completely absent from stones which originate from a skarn deposit (such as Namibia or Madagascar). Their presence does not guarantee a stone is Russian (as has often been suggested), but it does eliminate skarn-hosted deposits in a determination of locality.

Inclusions that, like 'horse-tails', are associated with serpentinite-hosted demantoid, are dark crystals of chromite or magnetite, sometimes chromium-rich, identified by electron microprobe analysis in the studies (**6**). These sometimes form the nucleation point of a 'horse-tail' but are also seen separate from that formation, either singly or in groups. They are reported in stones from Italy and Pakistan and the authors suggest that they are typical of stones with a serpentinitic origin; magnetite-bearing serpentinites being highlighted as one of the constituents of the host rock in the demantoid deposits of Val Malenco, Italy. These inclusions are notably absent in stones from skarn deposits.

Another mineral inclusion regularly seen in demantoid is diopside, either in acicular or aggregate form. The presence of this mineral appears not to be related to deposit-type as it is observed in samples from skarn deposits as well as being present in Russian demantoids. However, the form of the diopside does vary by location. In Russian stones diopside inclusions are colourless, acicular, rhombic in cross-section and striated parallel to the c-axis. Hollow tubes of the same shape are also observed, and the diopside inclusions have been confirmed in their identity by Raman spectrometry. Such inclusions, when seen alongside 'horse-tails', are very strongly indicative of Russian origin, not being noted in demantoids from other serpentinite deposits. Their absence in the samples from Pakistan is highlighted as being of interest in terms of distinguishing stones from the different locations.



*6: Chromite inclusions in a demantoid garnet from Baluchistan, Pakistan. Photomicrograph by Aaron Palke © GIA*

Diopside inclusions in Madagascan and Namibian stones are aggregates of white crystals, very different from the forms observed in Russian material, and are besides, never seen in combination with 'horse-tails'. White crystal inclusions of somewhat similar appearance are documented in both Italian and Pakistani demantoid, where they are identified as likely to consist of the serpentine mineral antigorite, so care must be taken to correctly identify such inclusions. In the samples from Italy and Pakistan, the white crystals are, of course, invariably seen alongside 'horse-tails'.

A greater variety of mineral inclusions are noted in skarn-hosted demantoid than in serpentinite-hosted. In addition to the diopside aggregates already discussed, the Madagascan samples contained wollastonite needles, and in one stone a pyrite crystal was observed. Many of the wollastonite needles were corroded, some to the extent that only hollow tubes remained. In Namibian stones, wollastonite, quartz, calcite and sphalerite were noted as mineral inclusions, sometimes in combination.

## CONCLUSION

As more sources of demantoid have been discovered, the traditional reliance on 'horse-tail' inclusions has become less helpful. Such inclusions remain diagnostic where present, but Russia is no longer the sole source, and many demantoids on the market are from skarn-hosted deposits in Namibia and Madagascar which do not contain these inclusions, causing the chances of seeing them to be reduced. More research into the characteristics and inclusions of demantoids from all localities is therefore necessary to aid gemmologists in identifying demantoid, in the frequent absence of 'horse-tail' inclusions and characteristic spectra. ■

*A full list of references and a bibliography are available upon request.*

# Shimmering Sapphires

Thanh Nhan Bui explores the beautiful and infinite optical variations in a new variety of 'Gold Sheen'™ Sapphire from Kenya.

*1: Rough.*

## INTRODUCTION

Mineral corundum is the crystalline phase of aluminium oxide forming ruby and sapphire. For those with an elementary knowledge of gemstones, ruby and sapphire are usually associated with red and blue colours respectively. Actually, sapphires can exhibit a large range of colours due to different impurities present in the crystal. Moreover, when foreign needle-shaped inclusions parallel to specific crystallographic directions are present in sufficient quantity, the stones display an optical effect known as asterism – when reflected light produces a 6 or 12 rayed star in cabochon cut stones. Strong shimmering effects, present for example in sunstones, are quite rare in corundum and are rarely reported in the gemmological literature or noted on the gemstone market. Here, however, we describe a new variety of sapphire from Kenya displaying such an optical effect: the 'Gold Sheen'™ sapphire.

Already noticed by researchers before 2000, rough parcels of 'Gold Sheen'™ sapphires were brought to the gemstone market in Bangkok at the end of the last decade by African gem brokers and were offered to several gem dealers. Their overall appearance is dark and opaque, but they displayed a subtle golden shimmering effect on their basal planes (**1**). Its exact location in Kenya is a matter of debate in recent gemmological literature but current discussions situate on the Dusi mine, located near Garba Tula, in Isiolo county, central Kenya.

*2: Colours.*

The first comprehensive study of this stone was published in *The Journal of Gemmology* in 2015, followed by further updates in gemmological journals and reports and interviews in jewellery magazines, demonstrating the great attention on this new variety of corundum. Since their launch, the gradual unpacking of rough bags and the improvement of cutting skills has brought out several varieties belonging to 'Gold Sheen'™ sapphires. Here we shall explore the features of the wide varieties in this new type of corundum.

## COLOURS AND GOLDEN SHEEN EFFECT

Two elements contribute to the colour of 'Gold Sheen'™ sapphires: the body colour of the sapphire and the golden sheen effect. The body colour can be yellow, green, blue or a combination of these three colours in different intensities and shades. Most of the sapphires display a unique and peculiar golden sheen effect, resulting from the presence of platelets and acicular inclusions identified as an exsolution of hematite and ilmenite ('sheen inclusions'), scattered in the stone matrix (**2**).

## TRANSPARENCY

The presence of the sheen inclusions near the surface of the gemstone creates the golden sheen effect. Of the two factors that impact the colour composition of the stone, only the sheen inclusions influence the transparency. This is directly related to the density of sheen inclusions along the c-axis of a sapphire, i.e. the thickness of the cut stone. While high density leads to a

brownish sheen and an opaque stone, low density produces a fine golden sheen and a translucent stone (**3**). The overlap of a layer of yellow sapphire above sheen inclusions significantly enhances the golden colour. In the case of a layer of blue sapphire with sheen inclusions, a blue sheen is created (**4**).

## HEXAGONAL PATTERN

Colour zoning is a classical phenomenon in corundum and results in straight growth bands following crystal faces of sapphire in a hexagonal pattern. Usually, growth bands are observed as alternating colours in the body of the sapphire. Here, the exsolution, responsible for the presence of sheen inclusions, generates alternating golden sheen areas with pristine sapphire, or golden sheen areas of different densities (**5**). These features demonstrate the variety of impurities

*4: Mixed colours*

present during the crystal growth of a sapphire. This gives rise to some rare and spectacular entire hexagons in the sheen area of some pieces. Fragmented roughs of 'Gold Sheen'™ sapphires, the most commonly encountered, lead to truncated hexagons with growth bands intersecting at 120°, or even only one set of parallel growth bands.

## DARK VEINS

The significant density of sheen inclusions, essential to producing the golden sheen effect, induces natural cracks in the stone. These surface-reaching fractures in the sheen area are similar to random and asymmetric dark veins, generating unique patterns which add value to their beauty (**6**).

*3: Transparency.*

> While high density leads to a brownish sheen and an opaque stone, low density produces a fine golden sheen and a translucent stone.

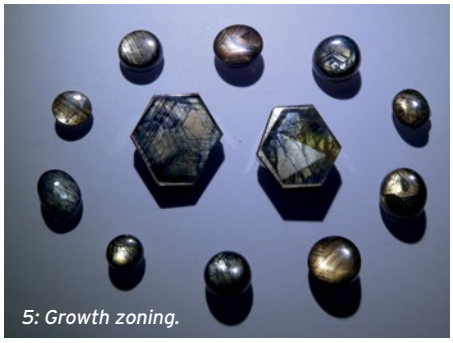
## LIGHT SOURCE

Light is crucial to illuminate stones in order to observe their colour and optical properties. The grading system of diamond is based on a daylight source, with particular specifications. Some gemstones, such as alexandrites, display a different colour in a daylight or under incandescent light. Here, the body colour of sapphire and the golden sheen effect both contribute to the overall natural optical effect of the stone. Stunning colour change occurs depending on the light source, mainly due to the presence of the sheen area. While white light or daylight can enhance the blue sheen, incandescent light strengthens the golden sheen (**7a** and **7b**).

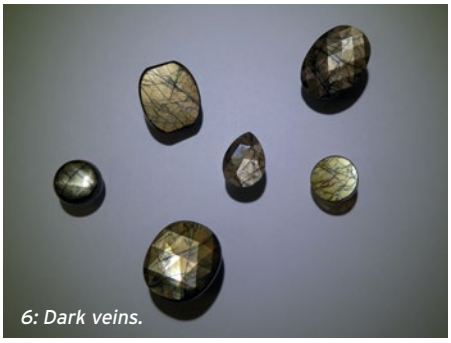
## CUTTING STYLE

Regardless of the cutting style, the stones are always cut so that the sheen inclusions are oriented parallel to the girdle profile, to emphasise the golden sheen effect. As like all gemstones, they are faceted or cut *en cabochon*. The average loss of weight is around 60%, depending on the rough and the required cut.

The faceted gems were cut into various common and fancy shapes. Due to the presence of the golden sheen effect in the material, there is no need to optimise the proportions of the crown and pavilion for the brilliance. Many of them were fashioned into checkerboard cuts on the front side and a flat face on the back.



*5: Growth zoning.*



*6: Dark veins.*

*7a and 7b: Showing the enhancement of the golden effect by using an incandescent light (right).*

Domes of the cabochon must be slightly flat in order to optimise the golden sheen effect, but also deep if a star is being highlighted. This is a trade-off between the golden sheen effect and asterism.

Among the sheen inclusions, those having a needle shape intersect at 60/120° according to the crystallography of the corundum matrix. When they are present in the stone in sufficient quantities, they produce a star if the stone is cut *en cabochon*. Due to the nature of these inclusions, the star displays 6 rays, is gold and its rays are parallel to the colour zoning or growth bands (**8**).

Due to the uniqueness of each gemstone, the matching of pairs – or a set – is quite challenging. Pairs possessing the same pattern are possible, requiring a rough piece that is cut in two for each side. This technical produces pairs with perfect matching (**9**).

## SIZE

The typical sizes of 'Gold Sheen'™ sapphires range from less than a carat up to about 20 carats. A large quantity of rough is required to supply parcels of calibrated sizes (**10a**). Pieces weighing up to more than 300 carats are easy to find and cut (**10b**). While small sizes are suitable for jewellery, the largest ones constitute collector or museum pieces.

## TREATMENTS

The cutting and polishing of the rough material is currently the only process imposed on these 'Gold Sheen'™ sapphires. The stones sold in the gemstone market are natural with no indication of heat treatment. Previous experiments (unpublished) demonstrated that heat treatments do not enhance the golden sheen effect or the possible 6-rayed star. Thus, there is currently no reason to apply any treatment on 'Gold Sheen'™ sapphires. Samples have been tested in several distinguished laboratories around the world, mentioning the rare and unique golden sheen effect displayed by the stone including: HRD Antwerp, SSEF, GRS, AIGS, GIT, Lotus, GIA and many more.

## PRICE

When 'Gold Sheen'™ sapphires first entered the gemstone market in 2014, their price was about $10 per carat. Nowadays, thanks to reports in jewellery and gemmological literature, conferences, and sales at gems and jewellery shows, the price begins at a few tens of dollars per carat and reaches about $750 per carat for the best quality pieces sold to wholesalers or retailers.

The price depends mostly on the golden sheen effect, the transparency, the size, the body colour of sapphire, the pattern created by the sheen area and the dark veins, and the quality of the 6-rayed star in the case of star sapphires. 'Gold Sheen'™ sapphires are valuable when the stones are highly translucent but the presence of sheen inclusions, necessary to create the golden sheen effect, decreases their transparency. This trade-off is identical to fine star gemstones. The best pieces of 'Gold Sheen'™ sapphires, showing a subtle golden sheen effect, are almost transparent. Among the unsorted rough, about 30% have a commercial value, 30% are good quality, 20% are fine and of 20% extra fine quality.

*8: Stars.*

*9: Pair.*

*10a (left) and 10b (above): Large pieces.*

## FINAL WARNINGS

'Gold Sheen'™ sapphires is the most widespread appellation of this new variety of corundum. It has recently become a trademark owned by Tanzim Khan Malik. Some wholesalers currently present the same stone under other names, which may confuse consumers.

Due to the recent notoriety of 'Gold Sheen'™ sapphires, and considering their slight similarity with black (star) or brownish sheen sapphires originating in other localities, some sellers would be tempted to associate these resembling varieties under the designation 'Gold Sheen'™ sapphires for a better sale.

## CONCLUSION

Through the different features explored here, a rich variety exist in 'Gold Sheen'™ sapphires due to the combination of the body colour of the sapphire, and the presence of sheen inclusions accompanied with fluctuations during the crystal growth. These features, combined with their pattern in the corundum matrix, renders each cut piece unique. To the best of our knowledge, the only known deposit is located in Kenya and is already depleted of high quality stones. The whole stock is now based in Bangkok and will fulfil the gemstone market for the next few decades. Nature has no secret when creating 'Gold Sheen'™ sapphires and the story of each composed stone tells the whims of nature. Most of them are unique pieces of art.

## ACKNOWLEDGEMENTS

We would like to express our gratitude to Tanzim Khan Malik (Genuine Gems & Jewellery), for sharing information on 'Gold Sheen'™ sapphires and supplying the images for this article. ■

*All the figures were photographed with a daylight lamp, except figure 7b as already noted.*

# A VIEW FROM THE TRADE: **BRANDING GEMS**

**In response to this interesting article, experienced gemmologist Grand Hamid FGAA DipDT, an Honorary Life Member of the Gemmological Association of Australia (GAA) and director of Hamid Bros Pty Ltd, shares his thoughts on the branded transformation of abundant and unmarketable 'bomb' sapphires into Gold Sheen™ sapphires and how this may set potentially unnerving precedents in the trade.**

This material from Kenya was presented to me several years ago and I was asked my opinion on it by an enthusiastic seller. As a dealer in fine crystalline sapphires, I have a love of the brilliance and life in a beautifully faceted gem, so relying on reflection off the surface of an opaque stone is not greatly appealing. In my opinion, there may be a market for this type of stone in the 'artistic' or 'alternate' jewellery sphere at a reasonably low price. However, I don't feel it will be desired amongst the mainstream or classical jewellery fraternity.

From a gemmological point of view it had some interesting features, including the hexagonal growth, the reflection off the golden fibres and the odd piece having a certain attractiveness to it. However, the vast majority exhibits crazing or fracturing of the surface and patchy colouration, which defies one of the basic tenants of a gemstone... that is to be pretty.

The issue of trademarking natural gemstones or terminology for them is disturbing to me. It may be brave of the owners to spend their money on trademarking but in my personal opinion it attempts to convey ownership or a monopoly on something nature created for all of us.

# Regarding Rutile

**In the final part of a year-long series for *Gems&Jewellery*, Billie Hughes of Bangkok-based gem testing lab, Lotus Gemology, shares pairs of photographs that, when placed side-by-side, reveal the full story of an inclusion or treatment. In this issue, we delve deeper into rutile inclusions in ruby and sapphire...**

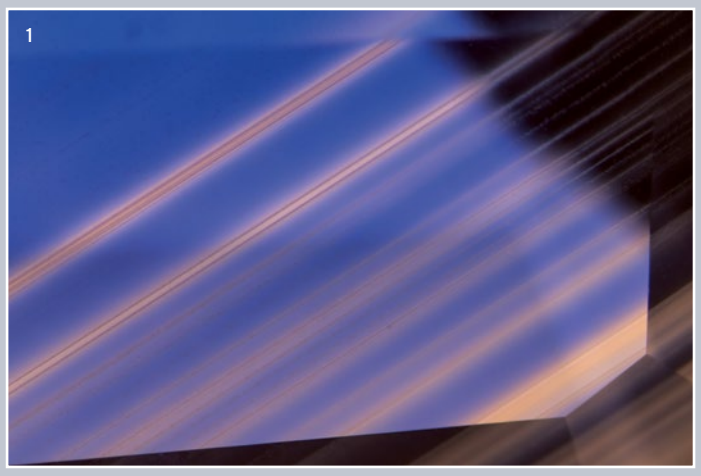
A common inclusion in ruby and sapphire is the titanium-rich mineral rutile. Many gemmologists become familiar with rutile in corundum when they first see long, thin needle-like rutile inclusions creating a beautiful 'silk' appearance in stones.

Aside from having a striking appearance, rutile 'silk' can also give us clues as to whether a ruby or sapphire has undergone heat treatment at a high temperature. In untreated stones, the rutile often forms long needles or strings of particles (**1**). As titanium is drawn out of solid solution to form exsolved rutile silk, the area in the immediate vicinity is decolourised, therefore losing its blue colour. This has been termed "chromophore cannibalisation" by master photomicrographer John Koivula, and is an indicator that the stone has not been heated to a high temperature.

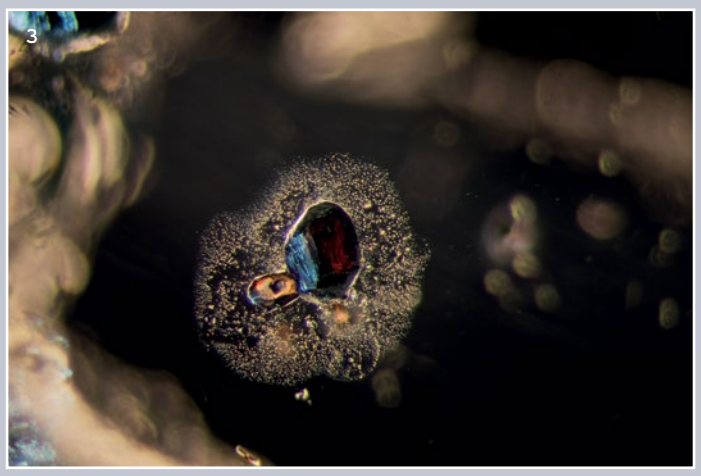
When a stone is heated, the treatment sends the titanium from the rutile back into solution, creating blue clouds that look like ink spots around the rutile remnants, termed 'internal diffusion' (**2**).

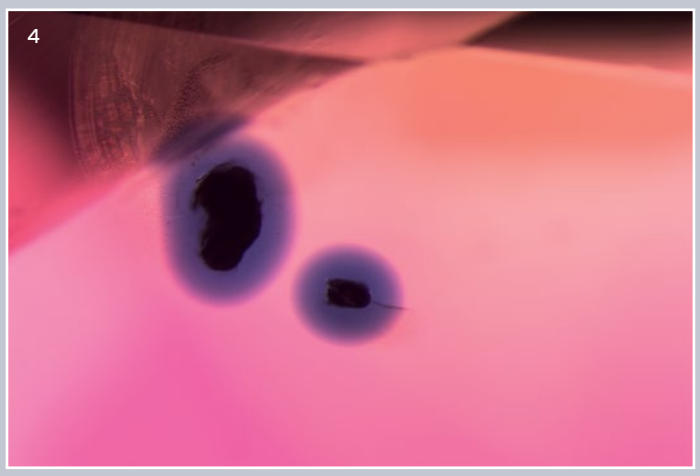
Rutile doesn't just form in elongated needles, but can also form in more rounded crystals called primary rutile (**3**). When heated to a high temperature, these too can bleed titanium into the surrounding corundum, creating a blue halo around the crystal (**4**).

When looking for these features, we recommend using light-field illumination and/or a white filter, which will make it easier to see both chromophore cannibalisation and internal diffusion. ■








*1: An example of "chromophore cannibalisation" according to the photomicrographer, John Koivula.*
*2: Blue clouds that look like ink spots in an example of 'internal diffusion' in corundum.*
*3: An example of a primary rutile inclusion in an untreated gemstone.*
*4: A 'melted' primary rutile inclusion with its typical halo in heat-treated corundum.*

*Photos courtesy of E. Billie Hughes. More photomicrographs by Lotus Gemology are available to view via its Hyperion archive at lotusgemology.com.*

# A pocket full of Shungite

**Despite its non-descript dirty-grey hue, shungite has developed a mystical reputation for the extraordinary. Sarah Steele FGA DGA considers the rise in popularity of this not-so-unremarkable material.**

Gems&Jewellery *contributor, Sarah Steele FGA DGA, delves into bags of shungite, which is widely seen at gem and mineral shows globally.*

As a geologist and gemmologist I am often asked about the metaphysical properties of certain materials. Personally, as a non-believer, I usually reply that most of the properties exhibited by gemstones are easily explainable by science; the quartz movement is a good example. Yet there are a few gem materials for which the benefits to both human health and our environment cannot so easily be denied. One such material is shungite.

Anybody who has attended the mineral show circuits of recent years will have witnessed the rise in popularity of this rather unremarkable-looking dark silver-grey coloured material, usually made into beads and amulets but also pyramids, spheres, drinking vessels and a plethora of other ornaments. So what exactly is shungite, and should we all be carrying it in our pockets?

The first written accounts of the attributes of shungite (then termed 'slate rock') date from the 16th century reign of Ivan the Terrible (the Grand Prince of Moscow) and document particularly pure spring water that sprang from it. During the reign of Peter the Great (1682 – 1725) a number of spas were establish that were deemed particularly beneficial to those with liver problems and local copper miners suffering from heavy metal poisoning. Peter ordered by decree that all his soldiers must carry a piece of shungite with them, to put it in their flasks to ensure pure disinfected water. Following Peter's death, the spas closed and shungite was forgotten. It wasn't until the 1930s that medical studies of the water began, only to halt due to WWII.

In the 1970s, the ability of shungite to be resistant in a chemically aggressive environment, coupled with its high electrical and low thermal conductivity, was explored. Further studies over the last 40 years have confirmed that the unusual physicochemical and structural properties of shungite give it numerous industrial and environmental applications, including the ability to remove pathogenic bacteria and heavy metals from contaminated water.

Other valuable properties of shungite include its absorptional, catalytic, reduction-oxidation properties, as well as its ability to screen off electromagnetic and radio radiations, making it useful in various branches of science, industry and technology. It forms the basis of a variety of new nano-technological materials such as new conductive paints, fillers for plastic materials, rubbers, composite materials, concrete, bricks, stuccoing plasters and asphalts to mention a few.

*Shungite known as 'slate rock' in 16th century Russia.*

Shungite, it turns out, is elementary non-crystalline carbon with a metastable structure incapable of graphitisation, a minerloid composed of >98%.wt carbon. Non-mineralised, non-graphitised forms of carbon have fascinated mineralogists since the 18th century. Three forms (or 'allotropes') of pure carbon are diamond, graphite and Buckminster Fullerene. In all three allotropes the carbon atoms are joined by strong covalent bonds but in such different arrangements that the properties of the allotropes are very different.

Fullerenes were discovered in the lab by a research group lead by Harry Kroto, Richard Smalley, and Robert Curl in 1985, for which they were awarded the Nobel Prize in Chemistry in 1996. The first observed fullerene was $C_{60}$ or as it is now named, the Buckminster Fullerene. $C_{60}$ is not the only Fullerene to be discovered and in theory, an unlimited number of Fullerenes could exist, based upon twelve pentagonal faces, and any number of hexagonal faces.

Initially lab created fullerenes were in demand for their superconductivity but costly to produce, prices were comparable to those of gold with a high in 1993 of US$3,500/gm. Scientists in →

*Round orbs of shungite showcasing its dark grey-silver colour.*

France and the United States made the discovery that fullerenes offer advantages over ordinary carbon in making synthetic industrial diamonds; under high pressure, the $C_{60}$ atom fullerene can be compressed into diamond at room temperature, avoiding the high temperatures normally required to transmute graphite to diamond. Coupled with this, the fullerene molecule contains no hydrogen that would potentially form a colourless synthetic diamond. Following this discovery, numerous patents were issued in the 1990's related to the synthesis of diamonds and diamond coatings from fullerenes. However, it was the discovery of fullerene molecules within shungite in 1992 (Buseck et al.) that created the greatest stir, making shungite the only known natural rock material known to contain fullerenes.

The most famous locality where large deposits are found is in Karelia, Russia, near Shun'ga village (hence the name of the rock type). The reserve constitutes the most remarkable deposits of organic carbon from the Palaeoprotozoic (2.5-1.6Ga). Essentially a sedimentary volcanic succession, the reserve is developed over some 9,000km$^2$ and the estimated reserve of organic carbon is in excess of 250 gigatonnes.

Despite many Russian texts being written on the subject very few have ever been translated into English and over the last 200 years different definitions of shungite have led to confusion. The term shungite was initially introduced by Inostanzev (1879) to describe the black lustrous substance with >98wt.% carbon found around the village of Shun'ga. Ian Borisov (1956) classified shungites into five groups Shungite 1 – Shungite 5 reflecting 100%wt. carbon – <10%wt.carbon.

Yushkin (1995) suggested that as shungite is not a mineral the term should be reserved to the material >98%.wt carbon, and shungite bearing rocks should be described by composition and lithology, for example, shungite bearing chert.

The jewellery and gemstone trade, however, classifies shungite into three groups:

## TYPE I

Silver shungite with a metallic lustre, conchoidal fracture, low specific gravity and >98%.wt carbon. This type of shungite cannot be cut or polished for jewellery.

## TYPE II

Black shungite exhibiting a dull metallic sheen when polished, containing 70-50%.wt carbon and commonly shaped into beads, pendants, spheres and other ornamental forms.

## TYPE III

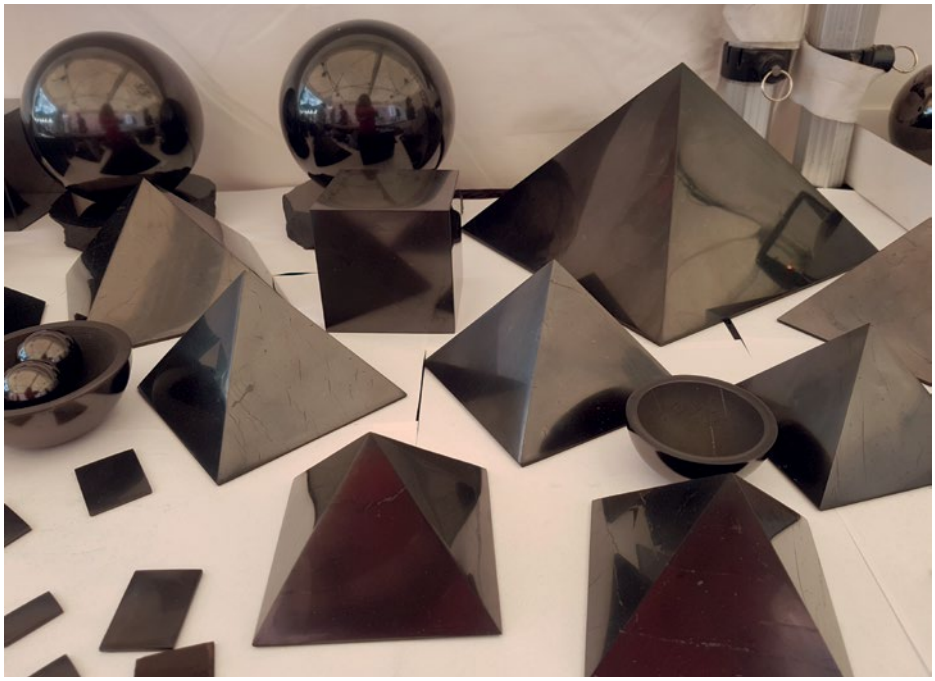
Grey shungite, with a 50-30%wt. carbon. This type is duller black-grey in colour and usually sold powdered for topical medicinal applications or small chunks for water filtration.

Black opaque stones can be difficult to identify, however a unique property of shungite is its excellent electrical conductivity. I have therefore found my Gem-A diamond testing probe a useful aid to identification, as it's the only black opaque bead material I have encountered which tests as a metal using the probe. Type II shungite also tends to leave your skin rather black for the initial few wears which is also a diagnostic tool.

When we consider its unique scientific properties, there is little wonder why shungite has become an important material for the crystal healing community. As a result, it is likely to remain common place at gem and mineral shows for the foreseeable future. ■

When we consider its unique scientific properties, there is little wonder why shungite has become an important material for the crystal healing community.

*A list of further reading can be accessed upon request. Images courtesy of the author.*



*Shungite is often fashioned into pyramid, sphere and bowl-shaped objects for the crystal healing community.*

# HOW DO YOU FOLLOW AN ANT TO A DIAMOND?

**Gem-A tutor Beth West FGA DGA EG takes us on a journey through the miniscule world of an anthill to discover a surprising link to diamonds.**

To an Arizonian ant, a pyrope garnet is never going to make a convenient scatter cushion. As these little creatures wriggle and busy about their extensive network of underground tunnels, if such a stone is encountered, it is expelled without ceremony from the nest. And there it is left to sit, a little wink of red at the foot of an anthill in the dusty landscape of the Central American desert.

It is without surprise that stones from this location are known as 'Anthill garnets'. They have been collected and revered by the Navajo Native Americans for thousands of years due to their blood-red hue when cut, prompting anecdotes as adventurous as the transformation of gems into bullets.

However, beyond their beauty, these garnets lend themselves to a greater gemmological purpose. Garnet is a high-pressure mineral that can form at great depths within the earth. It also forms as an isomorphous series, meaning that depending on the environment in which it grows it can slightly alter its chemistry, while ensuring its fundamental crystal form remains the same. In pyrope's case, it is a magnesium aluminium silicate, but a pure pyrope is rare and more often found incorporating other additional elements. In the case of 'anthill' garnets, they are rich in chromium and these 'chrome pyropes' have a rather auspicious bed fellow — the diamond.

Red garnet has been used to source diamonds since the South African diamond rush in the late 19th century. Although originally perceived to be ruby, these vibrant little stones were found in the same mantle derived rocks as diamond. This association allowed geologists to map the distribution of the garnet across the surface of the earth in order to locate existing kimberlite pipes — the mouths of archaic magmatic eruption and the most common source of gem quality diamonds.

However, although these pipes are abundant in some countries, only around one percent of those known are diamondiferous. So, despite the presence of the garnet, there was no guarantee that a diamond deposit would be found.

In the 1980s that changed. At around this time, the eminent South African geologist, John Gurney, had deduced that it was a very particular type of chrome pyrope that crystallised in the same environment as diamond. Within what is known as the 'diamond stability field', a point in the earth at which pressure and temperature are such that carbon will crystallise as diamond opposed to graphite, the calcium content in the host rock is low. Accordingly, the pyrope garnets that grow in this environment will have a very specific chromium to calcium ratio, and one biased against the latter. Gurney categorised them as G10 garnets.

He published in 1984, having up until then kept this 'recipe' close to his chest. But Russian research was beginning to sniff a little close to the mark and that pushed Gurney to print in order to ensure his name stood by his findings.

The disclosure of the G10 garnet to the geological community was a breakthrough for diamond prospecting. On the back of Gurney's publication, Canada – a country considered barren of the queen of gems – would find its first diamondiferous kimberlite. And the G10 garnet continues to be a key prospecting tool the world over.

However, it is with regret that I am left to inform the reader that, despite all their housework, our Arizonian ants have yet to uncover a diamond. Unless of course they are keeping the wealth to themselves. ■

> They have been collected and revered by the Navajo Native Americans for thousands of years due to their blood-red hue when cut...

# A Fresh Start for Colombian Emerald

*The Colombian Mining Landscape.*



*Luis Enrique Gonzalez (miner) in Variante tunnel, the Coscuez Emerald Mine*

**_Gems&Jewellery_ contributor Rosey Perkins GG shares her latest adventure to the Coscuez Emerald Mine and the exciting new initiatives shaping the future of Colombian emerald mining.**

At the 2nd World Emerald Symposium held in Bogota 12-14 October 2018, an array of corporate social responsibility initiatives were presented by emerald producers in Colombia. Trade organisations in Colombia are promoting a new era of 'Colombian Emerald' and an industry-wide collaboration is being called for with an 'appellation of origin' proposal, to be launched at CIBJO 2019. It aims to raise the profile, operational standards and sales of Colombian emerald.

I had the opportunity to visit various community initiatives around the Coscuez Emerald Mine, witness operations at the production face and document the core drilling programme. I also experienced the 13th National Miner's Festival, which was held in the small town of Santa Barbara, in West Boyaca, and the great pride that the communities have for their tradition of mining. Emerald jewellery isn't worn as widely in Colombia as you may imagine, but in West Boyaca men and women wear emerald jewellery and many include emeralds which were found, cut and set locally.

On a good day it takes five hours to travel approximately 220km from Bogota to Coscuez, or 35 minutes by helicopter. I felt fortunate to be allowed into the mine, as a tradition in West Boyaca has considered it bad luck for women to enter the tunnels. Equipped with a helmet, head lamp, survival pack, breathing apparatus, overalls and boots, I followed Vasco – Fura Gem's exploration geologist – into the La Paz tunnel to document the core drilling programme, the first in Colombian emerald mining history to drill from underground to the surface. Towards the


*From Coscuez Emerald Mine, Fura Gems' team: Vasco Azinhaga, Segundo Gonzalez, Julio Espejo, Eduar Moura.*

*Another team competing in the National Miner's Festival annual race.*

mouth, it is easily wide enough for two carts carrying ore to pass each other and in places the walls appear painted or patterned like a beetle's back. We followed the drainage ditches and after 1.4km we took a tunnel that forked to the left. Stalactites of calcite dripped on us from above and the low rumble of carts being pushed from the production face reminded me of home and being on the London Tube. I had wrapped my camera in clingfilm to guard it from the humidity and the drips, and took a test shot of the geologist in front of me in the glow of my headtorch. We opened a door in our path and a new wave of warm air hit us. The tunnel narrowed and, like a dark room, it held a sense of promise.

We reached a group of miners who were waiting behind a door for the air to clear after a blast. After pausing with them we went through the door and started down a twisting set of wooden steps. The diamond core drill had been assembled at the bottom on a pad in an opening. Core samples were set alongside each other in marked crates: black, white, some crumbled "black sugar". Vasco made observations and checked on the operations while I negotiated the lighting and took some photos of the different stages of the sampling process. The equipment was handled by three men and as it hissed and puffed it felt as if we were in the belly of the earth. We were 88m down.

The way up was inevitably slower. The warm air weighs on the chest and I had stopped to set up lighting for a photo as a miner approached. The noise of a fan prevented Vasco from hearing my instructions for lighting. From the top of a flight of steps I shouted louder and took the photos as best I could but the light was still too strong. I moved down the steps to fix the lights as a tired miner, who was going for lunch, started to move on. I didn't have the heart to keep him any longer.

The heat and humidity presented a physical challenge that both motivated me and demonstrated the stamina needed by miners. Their strength and skills are celebrated each year at the National Miner's Festival, at Santa Barbara. One of the main events of the festival is a men's race where carts are decorated, filled with 400kg of black shale, and raced by teams of four 3km down mountain roads from an elevation of 130m. Teams that underestimated the need for breaking ended up pulling upturned carts out of the ditches, while others faced a final ascent to the town square where a balance beam awaited them, a water-filled tunnel to crawl through, and then a final search through the ore in their cart for a green painted rock, symbolic of an emerald. The fastest team earns 3 million Colombian pesos (nearly US$800 per team).

For the women's race, pairs of female miners equipped with lamps, helmets and boots raced into the town square carrying between them a 12.5km sack of ore. They then washed the bag's contents and checked for a coloured ball that indicated cash prizes, the first prize being COL$1 million (approximately USD$300.) This year, 20 pairs of women entered and no participant went home empty handed as the mayor and various businessmen and officials made spontaneous donations that were divided between all the participants.

...pairs of female miners equipped with lamps, helmets and boots raced into the town square carrying between them a 12.5km sack of ore.

The role of female miners has traditionally been to wash ore as berraqueras, while men dig. Fura Gems recently launched a wash plant project, which will be run entirely by women. International investment is supported by the communities around Coscuez: "The communities here have a lower standard of living than many parts of the country and they recognise the opportunity that international businesses bring to improve it," a geologist from Boyaca said. The list of community initiatives among the producers in West Boyaca is extensive. With paternity tests now available for emerald, and work being done on blockchain to improve traceability, perhaps in the future Colombian emerald will be desired not only for its colour but also for its responsible practices. ■

*Women cleaning Rough.*

*Women workers at the Coscuez Emerald Mine.*

*All Image Credits Rosey Perkins.*

# Internal World

***Gems&Jewellery* talks to Tyler Smith about his striking photograph of a spire of negative crystal in a Sri Lankan 'ottu' sapphire.**

GEM-A GEMSTONE PHOTOGRAPHER OF THE YEAR 2018

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"This windowed Sri Lankan bi-pyramidal rough sapphire, with its tier negative crystals and faintly iridescent fissure, encapsulates why I am drawn to photomicrography. It alludes to the natural order of its formation while maintaining an alien atmosphere, blending together the real and imaginary. Large negative crystals such as these are hallmarks of Sri Lankan sapphires and serve as proof that the stone has not been subjected to heat treatment — crystals of this size would surely rupture during heating due to their thermal expansion."

*Tyler Smith is a coloured stone gemmologist working for GIA's New York laboratory. Both on the job and at home, he enjoys hunting for rare inclusions in gemstones for photomicrography subjects. He is especially interested in inclusions that provide insight on their host's geological history but isn't above taking a pretty picture just for the sake of it.*

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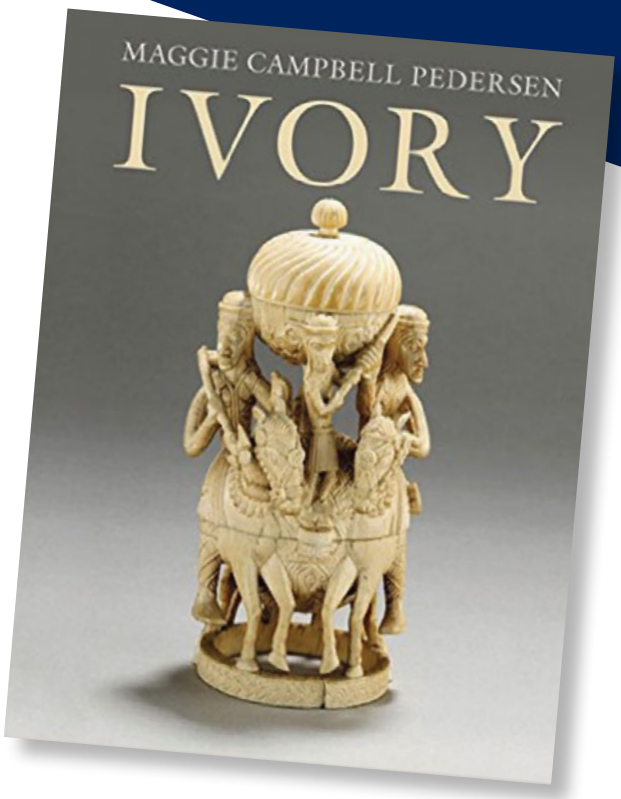


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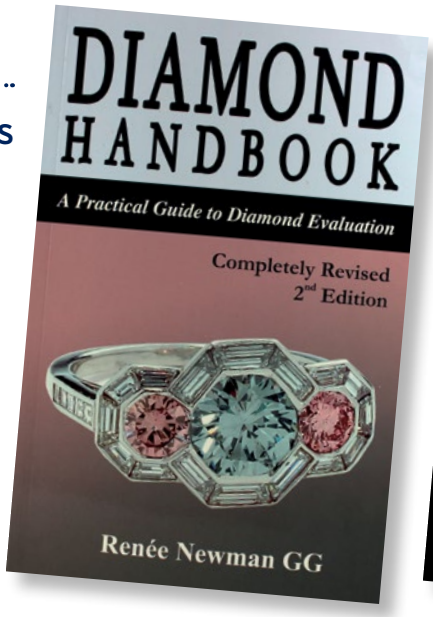


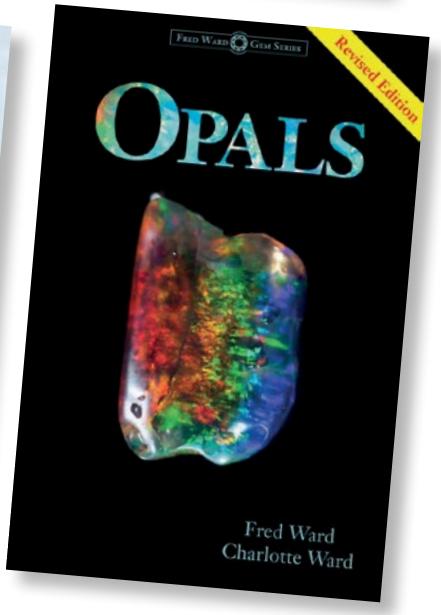


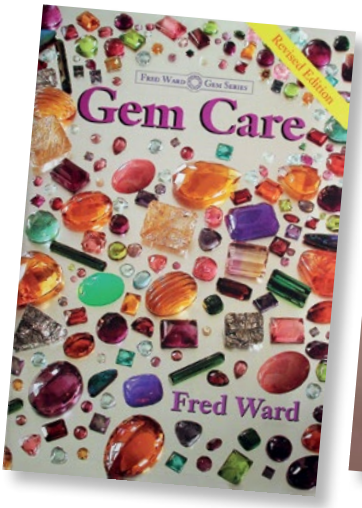


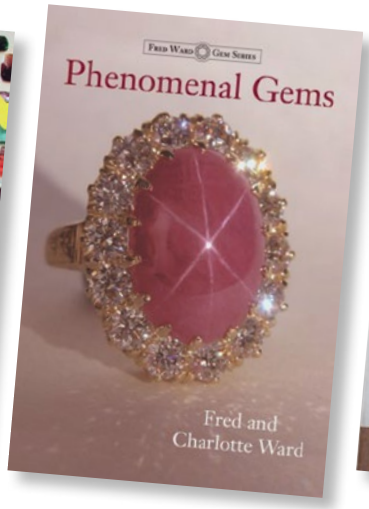



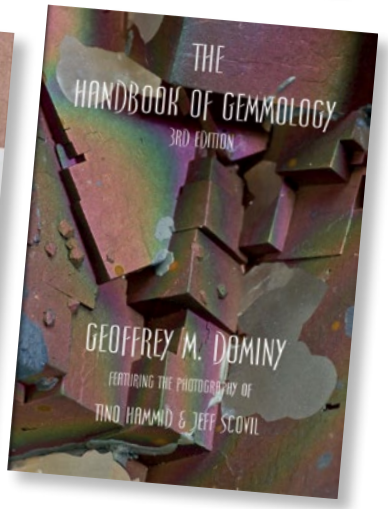


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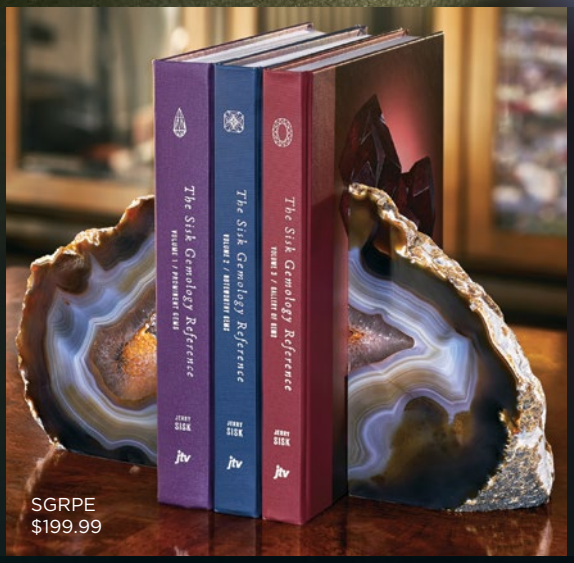


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