Gems&Jewellery

Summer 2018 / Volume 27 / No. 2

FOCUS ON FLUORESCENCE

IVORY ALTERNATIVES

PLATINUM HERITAGE

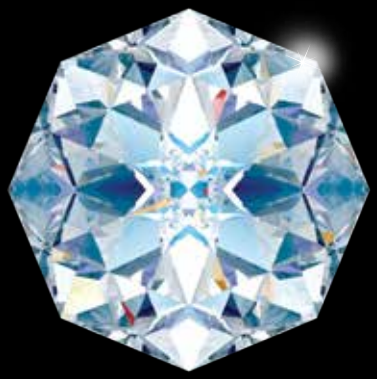
FIGHTING THE FAKES

GEMSTONES ON CAMERA

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

Canadian Gemmological Association

CELEBRATING 60 YEARS ANNIVERSARY



(c) Michiel (Mike) Botha, Master Diamond Cutter

SAVE THE DATE!

Gemmological Conference

October 19-21, 2018

Vancouver, British Columbia

Canadian Gemmological Association
55 Queen St. East. Lower Concourse, #105
Toronto, ON M5C 1R6

Tel. 647.466.2436 **Fax. 866.757.9603**
info@canadiangemmological.com
www.canadiangemmological.com

Gems&Jewellery
SUMMER 2018

FOCUS ON FLUORESCENCE

Lily Faber FGA DGA, delves into fluorescence and explains why it can be an enlightening and enjoyable testing technique for gemmologists.

THE PAST AND PRESENT OF PLATINUM

Starla Turner FGA GG explores the history of platinum and its influence on jewellers since the 1700s.

INVESTIGATING FAKE ROUGH

Gagan Choudhary FGA alerts us to the various types of fake gem rough currently in circulation, including mica rock as Emerald, CZ and topaz as diamond, and synthetic quartz as aquamarine.

COVER PICTURE

Brazilian aquamarine showing vibrant interference colours and a 'fingerprint' inclusion as viewed parallel to the optic axis using polarized light. Field of View: 4.87mm
Image Credit: Nathan Renfro FGA

Published by
The Gemmological Association of Great Britain (Gem-A)
21 Ely Place, London EC1N 6TD
t: +44 (0)20 7404 3334
f: +44 (0)20 7404 8843
e: editor@gem-a.com
w: www.gem-a.com

Registered charity no. 1109555

Gem-A is a company limited by guarantee, registered in England, number 01945780

Editor: Sarah Jordan

Deputy Editor: Sarah Bremner

Design and Production
Zest Design +44 (0)20 7864 1504

Editorial and Advertising
For editorial enquiries, mediapack and advertising rates please contact editor@gem-a.com.

Gems&Jewellery

Summer 2018 featured contributors

1. GAGAN CHOUDHARY

Gagan Choudhary FGA is the deputy director at the Gem Testing Laboratory, Jaipur. Choudhary has a Master's Diploma in Gem Identification from Gem Testing Laboratory, Jaipur, India, a Diploma in Gemmology from Gem-A, and has completed the Scientific Gemmology Course from SSEF, Basel. He is currently in charge of certification and research activities of the Jaipur laboratory. The author of *Understanding Rough Gemstones and Gems & Rocks* (in Hindi), Mr. Choudhary is also the author of gem-passion.com, where he has shared numerous reports on interesting gem materials and other gem-related articles. He is also an editor of the Gem News International section of GIA's *Gems & Gemology* journal.

2. STARLA TURNER

Starla Turner FGA, GG joined Lang in 2012 where she specialises in gemstone and jewellery grading and identification. She loves using the microscope all day long to determine the construction of jewellery and the metals used, as well as to make assessments of gemstones — a perfect job in her eyes. Her jewellery and education credentials include a BA in Education from the University of British Colombia, and her roles as a tutor for Gem-A's Gemmology Diploma and mentor for the GIA's Graduate Gemmologist program. She has been an instructor of gemmology and diamonds at Revere Academy in San Francisco for 15 years, and has been a past president of the global GIA Alumni Association Executive Council (1995 – 2013) and co-president of the San Francisco chapter of the GIA Alumni Association, since 1992. Starla is also a gemstone pricing advisor/researcher for an industry publication. For fun, she plays competitive soccer, enjoys time with her family, and travels the gem world.

3. BILLIE HUGHES

Billie Hughes is a gemmologist and founding member of Lotus Gemology Laboratory in Bangkok, Thailand. She became a fellow of Gem-A in 2013. Her gemmological work has appeared in *Gems & Gemology*, *The Gemguide*, *The Journal of the Gemmological Association of Hong Kong*, and *InColor* magazine. She has also distinguished herself with her photographic work published in *Terra Spinel*, *The Wall Street Journal*, *Ruby & Sapphire: A Collector's Guide*, and *Ruby & Sapphire: A Gemologist's Guide*. Billie is also a talented photomicrographer and three-time winner of the Gem-A's annual photographic competition.

4. NATHAN RENFRO

Nathan Renfro completed his undergraduate degree in geology in 2006. In 2007 he received his Graduate Gemmologist diploma from GIA and completed the Gem-A Gemmology Diploma in 2014. Renfro is currently the manager of the gem identification department at GIA in Carlsbad, California. He is also the editor of *Gems&Gemology's* 'Microworld' column.

5. MAGGIE CAMPBELL PEDERSEN

Maggie Campbell Pedersen FGA is President of Gem-A and an associate of the British Institute of Professional Photography. She is an accredited lecturer for the Arts Society (formerly NADFAS) specialising in organics, with two published books.

With additional thanks to

Lily Faber FGA EG
Dr Jonathan Breeze
James Zigras
Steve Moriarty, Associate of Gem-A
Jack Odgen FGA and Yale University Press
Natalie Graham
Lizi Glazebrook
Amelia Grant
Rebecca Tsang

Straight from the heart

Opinion and comment from CEO, Alan Hart FGA DGA

Welcome to the Summer 2018 issue of *Gems&Jewellery*. I hope you are all preparing for a richly-deserved escape, whether that's a family trip or a gemmological excursion. If the latter, please don't hesitate to share your experiences with this magazine — you may find your adventures covered in one of our upcoming issues. Although one can never confirm the great British weather, I have a sneaking suspicion it is going to be a fantastic June, July and August… although perhaps I should reserve my optimism and check back in the Autumn 2018 issue, due to arrive in October.

The last few months have been a busy time for Gem-A, with some great Gem Central evenings that have broadened the gemmological conversations among our members. Do keep checking the schedule of events on the Gem-A website to ensure you don't miss out.

In April, I attended the AGS Conclave in Nashville, Tennessee, which was packed with fantastic speakers and great conversation. This, of course, reminds me of the annual Gem-A Conference, which will be back on the weekend of November 3-4, 2018. Don't forget to save the date. Even at this early stage we can't miss an opportunity to thank JTV, who have once again signed-on to be a Platinum Sponsor of the Gem-A Conference. Please also join us in thanking the Canadian Gemmological Association (CGA) for becoming a Silver Sponsor. There is still plenty of time to join this roster of supporters, so please visit the Gem-A website to view our sponsorship brochure.

Also, exciting news for Gem-A students graduating in 2018; the annual ceremony will be held at a new venue – the Royal Institution of Great Britain – that actually has surprising links to Gem-A. Incredibly, the youngest ever Nobel Laureate in physics, Sir William Lawrence Bragg, who secured the prize for his work in crystallography in 1915, spent his later years as resident professor and lecturer at the Royal Institution and as Gem-A president! Sir Lawrence Bragg, as he was known, held various senior positions at the Royal Institution from 1938, including director from 1965 to 1966. He served with Gem-A from 1954 until his death in 1971. We hope our Gemmology Diploma and Diamond Diploma students will soak-up this storied history as they arrive to accept their certificates. We really do have some fascinating members, both old and new.

It was great to hear from entrepreneur Kathy Ireland at AGS Conclave.

Typically at Gem-A, the summer months are useful preparation for the hustle and bustle of September, which sees busy trade events in London and Hong Kong. I don't know about you, but this year seems to be racing by. I hope you will find a few moments to slow down, put your feet up, and read this latest issue of our magazine. There is a slight American flair to this issue, with some fantastic interviews with quartz miner, James Zigras, and gem-cutter, Steve Moriarty. This issue also features a great piece by Starla Turner FGA GG on platinum jewellery throughout history, and Gagan Choudhary FGA on the fake rough material that has passed his desk. As usual, we've packed this issue with some great photography… including the most romantic image of a digger we've ever seen from Nathan Renfro!

All that is left to say is enjoy the issue and your summer holidays.

Best wishes
Alan Hart FGA DGA

> **The last few months have been a busy time for Gem-A, with some great Gem Central evenings that have broadened the gemmological conversations among our members.**

I was invited by Natalie Graham of JTV to be a guest in her gemstone 'unboxing' videos on YouTube. Find out more on page 36.

Gem-A News

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

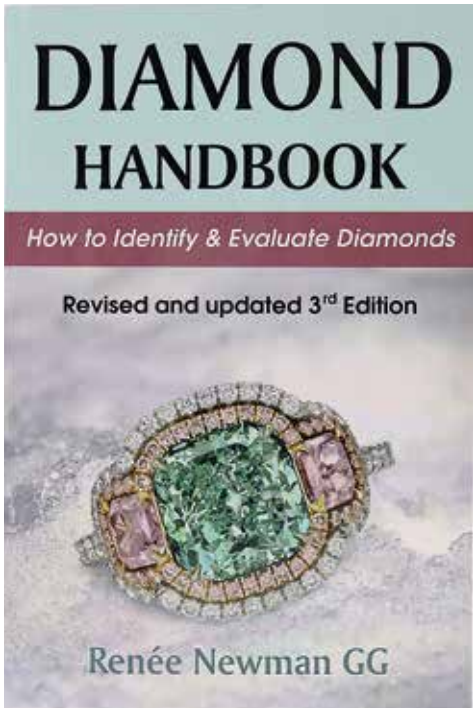
A SPARKLING RESOURCE

Gem-A Instruments assistant, Sophie Cox, spotlights the revised and updated third edition of the *Diamond Handbook: How to Identify & Evaluate Diamond* by Renée Newman GG, which is now available to buy from Gem-A Instruments.

The new 3rd edition of the *Diamond Handbook* is more advanced than ever before with updated information and photos on everything you need to know about identifying and evaluating diamonds. Highly recommended for professional gemmologists and those with a specific interest in diamonds, this book features need-to-know information, covering basic diamond facts, price factors, treatments and methods of detecting synthetic diamonds.

Notable additions are colour images of diamond spectra, a chapter on detecting transparent and black diamond imitations, and updated photos in the chapters on fancy colour diamonds and antique diamond jewellery. Most importantly, the author has updated the previous edition (published in 2008) to reflect major changes in the diamond trade, so even if you are already lucky enough to own a copy it is well-worth investing in this newer edition. ■

If you require further information, advice or to purchase your copy, please email instruments@gem-a.com



RRP £17.50
Current Gem-A members and students receive a **5% discount** on books.

IS OUR NEW DIPLOMA PREPARATION RIGHT FOR YOU?

If you've passed the Gemmology Foundation course but need a refresher before moving onto Diploma, this short course is ideal for you. The course will return to the elements covered in Foundation and will enable you to move into Diploma with confidence. Currently, this is only offered in London at Gem-A HQ.

Courses will take place from 20-24 August 2018 and 28 Jan-1 Feb 2019. Prices start from £600 for members and £750 for non-members. To find out more, email *education@gem-a.com*.

ACADEMY OF VALUERS INTRODUCES ALAN HODGKINSON BURSARY

The newly-established Academy of Valuers has received a donation of gemmological instruments from established gemmologist and teacher, Alan Hodgkinson FGA DGA, leading to the creation of a dedicated Alan Hodgkinson Bursary. The bursary winner, to be decided by Hodgkinson personally, is designed to support a worthy applicant both financially and educationally on their journey to becoming a professional valuer. Highlights include free access to the Academy's workshops, a copy of Hodgkinson's book *Gem Testing Techniques* and a starter subscription to *GemGuide* – generously offered by Gemworld International Inc. president, Richard Drucker GG FGA (Hons). Find out more at *academyofvaluers.co.uk/alan-hodgkinson-bursary*.

OBITUARIES

Louis Van Ameringen FGA

Honourary life member, Mr Louis (Lou) Van Ameringen FGA, sadly passed away at the age of 94 in February 2018 at North Middlesex Hospital, following a short illness. A commercial traveller for many years with Emrich and Co., he is greatly missed by his wife Trudy of 70 years, his children, grandchildren and great-grandchildren. Sadly, due to poor health in recent years, Lou had been unable to get around as much as he once did, and was much missed by the gemmological community. Our thoughts at Gem-A go to Trudy, family and friends.

Twitter @GemAofGB

Facebook @GemAofGB

LinkedIn Gem-A

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

Instagram @GemAofGB

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

The Gem-A Conference 2018

Booking opens 4 June!

If you are a Gem-A member or student, you will receive an email with a code to unlock special member and student rates.

To book, go to Eventbrite:
https://gem-a-conference-2018.eventbrite.com

- Discover an amazing line-up of **speakers** from all corners of gemmology
- Network with **industry leaders** during the Conference and at the Saturday evening dinner
- Learn from speakers and **fellow delegates**
- Attend **exclusive workshops** and enjoy guided trips including private viewings
- Be part of our **global community** of gemstone and diamond enthusiasts and professionals
- The Conference concludes with the **Gem-A Graduation** and Presentation of Awards!

3-4 November
etc. venues
County Hall,
London, UK

Setting sun by the Missouri River, Montana

Analytical microscopist and photomicrography expert, Nathan Renfro, takes us behind-the-scenes of this striking image taken in Montana's 'Big Sky Country'.

In August of 2015, I was on a field expedition to visit several of the sapphire mines in Montana. On this day in particular, I was at the El Dorado bar on a mine site owned by Cass Thompson along the Missouri River. This was the second time I had visited this location and we had spent the day processing over 100 tons of sapphire bearing gravel.

Near the end of the day, I was walking around getting ready to eat dinner with the miners and the rest of the GIA team that was on this particular trip. It was getting late in the evening, the sun was making its descent and the sky was filled with lots of clouds. The combination of these features created some fairly dramatic crepuscular rays decorating the sky.

Since the state of Montana in the United States is sometimes known as 'Big Sky Country' and 'The Treasure State', this scene seemed to capture the mood of Montana sapphire mining within a single photograph. In the background is the Missouri River, and the weathered appearance of the loader gives the impression that it has certainly helped recover countless sapphires. Those features, paired with the sun beams traversing the sky, just polished the whole scene off, letting the viewer know that they are in Montana's 'Big Sky Country'. ■

BE A GEM-A AWARD-WINNING PHOTOGRAPHER!

The Gem-A Photographer of the Year Competition takes place every autumn, with three competition winners and one overall winner named at the Gem-A Conference in November. To see your photography featured in *Gems&Jewellery*, simply enter one or more of your shots in the Internal, External and/or Humanity in Gems categories by Friday, August 31, 2018. To find out more turn to page 15, or email: *editor@gem-a.com*.

Photo Credit: Nathan Renfro.

The InSight Lander. This artist's concept shows the InSight Lander, its sensors, cameras and instruments. NASA/JPL-CALTECH.

Expect the Unexpected...

1: InSight Testbed at JPL. Engineers use a replica of NASA's InSight Lander at the agency's Jet Propulsion Laboratory, Pasadena, California. NASA/JPL-CALTECH.

With crushed garnet assisting the next mission to Mars, gemstones are being used in more innovative and unexpected ways than ever before. Here deputy editor Dr Sarah Bremner explores some fascinating uses for gems.

GARNET

Garnet has been valued as a gemstone since at least the Bronze Age. Aesthetically, garnet has been inlaid with gold using the cloisonné technique to create stunningly intricate designs – most recently seen in the Staffordshire Hoard discovered in the UK in 2009 – but garnet is also a useful abrasive, used by carpenters as specialist sandpaper, to replace silica sand in sand-blasting, and even to cut steel.

In the latest innovative use of this gemstone, NASA's Mars InSight mission – due to reach the 'Red Planet' in November 2018 – has been using crushed garnet to prepare for landings at the NASA Jet Propulsion Laboratory (JPL) in California (**1**). As Mars' surface is covered in sand and gravel, garnet has been used to simulate the surface conditions that the InSight Lander will encounter as it touches down. Garnet mimics the range of particle sizes found on Mars but, crucially, doesn't produce dust that can hamper the efforts of scientists. NASA engineers have also focused their attention on how the InSight Lander will cope on uneven or tilted surfaces, using piles of garnet to create manoeuvrability challenges that could impact the setting-down of three essential tools: an ultra-sensitive seismometer; a shield that isolates the seismometer from wind and temperature swings; and a heat-flow probe.

Landing at Elysium Planitia, a broad plain that straddles the equator of Mars, the InSight mission will spend 708 sols (728 Earth days) exploring the planet to conduct the first in-depth 'health check-up' of Mars since it formed 4.6 billion years ago.

Garnet
Chemical Composition: (A)CA/Fe/Mg/Mn (B)AI/C/Si/Ti/Zr/Vn Silicate
Hardness: 6.5-7.5
Crystal System: Isotropic
SG: 3.3-4.2

SYNTHETIC DIAMOND & SAPPHIRE

In ground-breaking, first-of-its-kind research published in March 2018, scientists at Imperial College London and University College London (UCL) successfully created the world's first continuous room-temperature maser

2: Synthetic Diamond used in maser. Image Credit: Thomas Angus, Imperial College London.

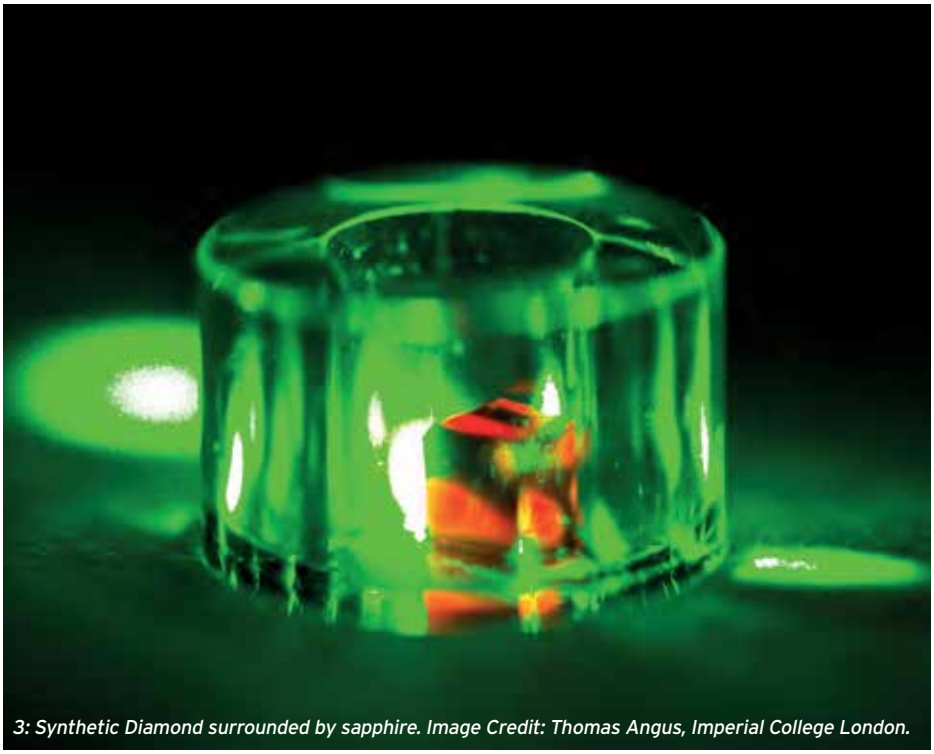
(microwave amplification by stimulated emission of radiation) using a synthetic diamond and a ring of sapphire. Masers, first created in 1954, are the microwave-frequency predecessors of lasers. As they could only function at cryogenic freezing temperatures, masers were mainly used in deep space communications and radio astronomy. However, Dr Jonathan Breeze and his team utilised the properties and strength of synthetic diamond grown in a nitrogen-rich atmosphere by Element Six (a De Beers Group company), to develop a maser that not only functions at room-temperature, but does so continuously (**2**).

By applying a high-energy electron beam to the diamond, it 'knocks out' carbon atoms that create spaces, known as 'vacancies'. When heated, nitrogen atoms pair with these carbon vacancies to create a defect within the diamond's structure known as a nitrogen vacancy (NV) centre. When placed inside a ring of sapphire to concentrate the microwave energy, and illuminated by green laser light, the researchers found that the maser worked continuously at room temperature (**3**).

This ground-breaking research could have a direct impact on our day-to-day lives too, from medical imaging, airport security, improving sensors and remotely detecting bombs, to creating new technology for quantum computers, improving space communication and potentially finding life on other planets!

ACKNOWLEDGEMENTS

In future research-projects, Dr Jonathan Breeze will be looking at other defects in diamond and also silicon carbide (moissanite). Gem-A thanks Dr Breeze and Imperial College London for sharing this research and for image permissions (Image credit: Thomas Angus, Imperial College London). ■



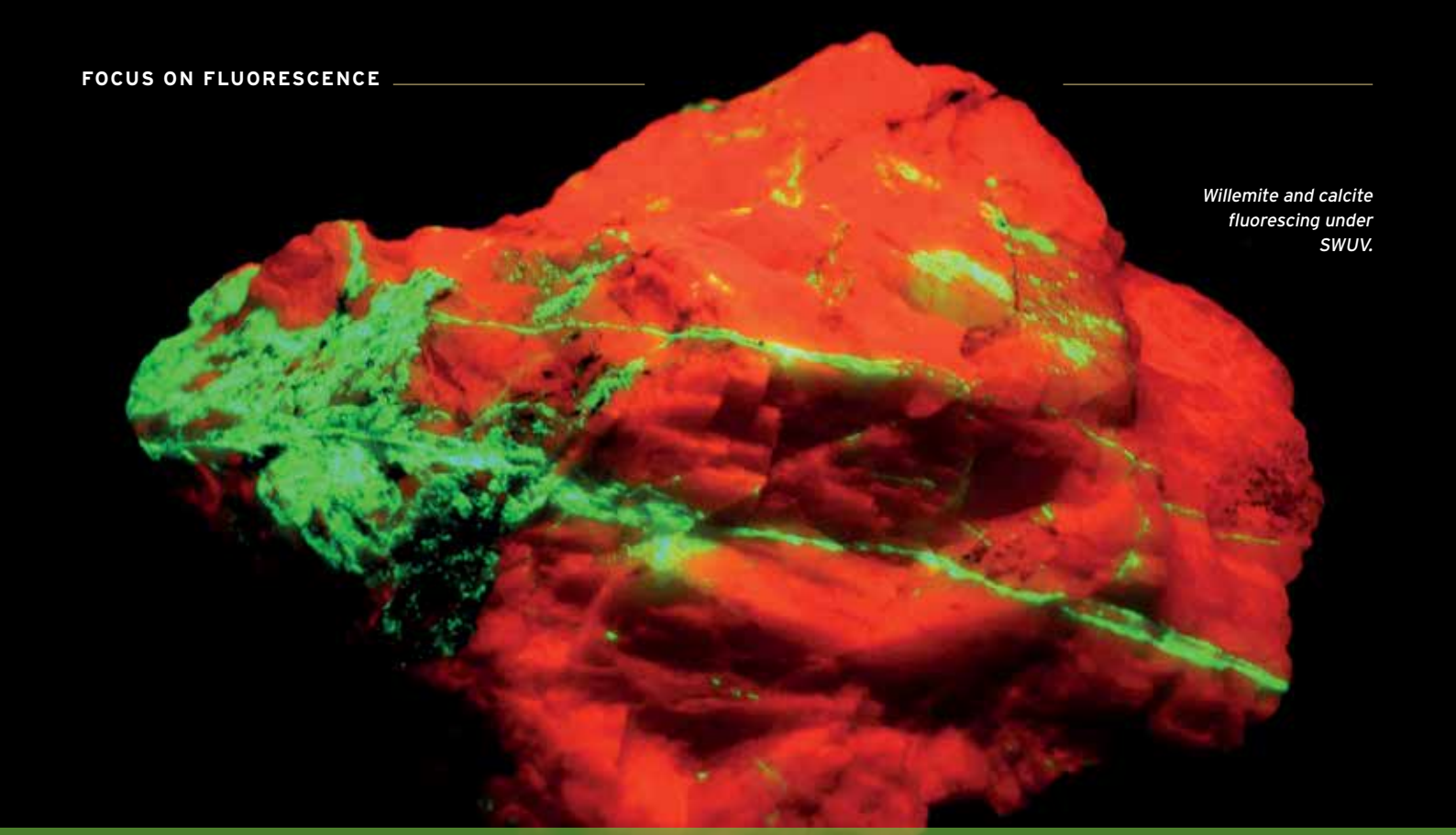
3: Synthetic Diamond surrounded by sapphire. Image Credit: Thomas Angus, Imperial College London.

Gem-A talks to lead-scientist, Dr Jonathan Breeze, as he shares some insights into this exciting research

What made you think of using gemstones in your research?
Scientists and engineers have always used minerals for their research, from glass prisms for diffracting light to silicon chips in electronics. My earlier research was in the field of ceramics for microwave electronics. Most of these ceramic materials are metal-oxide minerals, which have single-crystal (gemstone) counterparts such as sapphire, ruby, quartz, rutile and zirconia. In fact, the first masers and lasers used rubies — synthetic crystals of sapphire doped with chromium or titanium impurities. Furthermore, digital watches and computers relied on quartz single crystals to provide stable clocks, as do optical fibres. I am always considering these materials in my work, and some of them happen to exist as beautiful gemstones.

How significant has the use of synthetic diamond and sapphire been to this project?
Synthetic diamonds that contain nitrogen-vacancy defect complexes exhibit amazing quantum properties, known as 'spin'. Coupled with sapphire which has excellent electromagnetic properties – it absorbs very little microwave energy – resulted in a maser that allowed the stimulated emission process to build up to produce a coherent maser signal (in the same way as an optical laser works). The project would not have been successful without either diamond or sapphire.

Do you think that this will have a positive impact on the use of gemstones in other research projects?
This is difficult to say. Scientists have been growing crystals for centuries. Sometimes the crystals are exotic – not found in nature – and other times they are minerals and gemstones that we are all very familiar with. Indeed, some of the most significant discoveries in solid-state physics have initially been made with naturally occurring minerals or gemstones.



Willemite and calcite fluorescing under SWUV.

LOOKING FOR THE LIGHT

Most of us know about fluorescence in gemstones, but how many use it as part of their gemmological testing routine? Here, Gem-A gemmology tutor Lily Faber FGA DGA EG, delves deeper into fluorescence and explains why it can be both enlightening and enjoyable for gemmologists.

WHAT IS LUMINESCENCE?

When we use the term luminescence in gemmology, it generally refers to the term photoluminescence, which is the emission of a cold, visible light when a gem material (or general substance) is excited by light of a shorter wavelength. Two examples are fluorescence and phosphorescence.

Fluorescence occurs when a gem material is illuminated by radiation of shorter wavelengths with higher energy. The visible light emitted stops when the source of illumination is turned off. Phosphorescence, on the other hand, is a visible light that is emitted by a gem material after the original source of exciting radiation has been switched off. A famous example of a gemstone that strongly phosphoresces is the blue Hope Diamond, which glows a bright red for several minutes after being excited by short wave UV light. Both fluorescence and phosphorescence can have varying strengths from very strong to weak. If a material does not either fluoresce or phosphoresce, it is considered inert.

HISTORY OF FLUORESCENCE

Fluorescence has been observed for years, but it was not until Sir George Stokes extensively documented this effect in relation to gemmology that it officially became part of the scientific lexicon. In 1852, Sir George coined the word fluorescence, named after fluorspar, more commonly known as fluorite, which is a highly fluorescent material. The 'Stokes Law of Fluorescence' or 'Stokes Shift' states that the fluorescent emission of light will always be that of a longer wavelength than the excitation source, i.e. the light emitted is of a lower energy than its excitation source.

A bag of cubic zirconia under LWUV with areas of blue Fluorescence, highlight the presence of diamonds.

WHY USE FLUORESCENCE?

Fluorescence can be a helpful tool when used correctly. Some gemstones have a characteristic or, very rarely, a diagnostic reaction to UV light. One gemstone that notably both fluoresces and phosphoresces is a diamond, which typically fluoresces blue in longwave UV light and then phosphoresces yellow. This is a diagnostic result for a colourless to yellow diamond in the Cape series (Type Ia), but please be aware that fluorescence is rarely diagnostic as

reactions may vary wildly within the same species or variety of gemstone.

Fluorescence can indicate or confirm the identity of a stone. For example, citrine quartz is inert to fluorescence due to the presence of iron, which eliminates fluorescence. If you are testing a yellow stone that may potentially be a citrine , and it fluoresces orangey-yellow under LWUV and red under SWUV, it cannot be a citrine and is more likely to be a scapolite.

Other reasons to use fluorescence? It is quick and normally takes less than one minute to observe reactions. You can test gemstones that are loose, set, rough or fashioned, and you can test either single gemstones or multiple gems at the same time. Finally, it is entertaining!

Quartz under LWUV showing oil inclusions.

HOW DOES IT WORK?

Ultraviolet light (UV) is the most commonly used excitation source. We cannot see UV light as it sits just below the visible light spectrum (400nm-700nm) at 10-400nm. UV light enables us to see fluorescence because a gem material will absorb this radiation source and then emit light that is lower in energy and therefore visible to the eye. But what is actually happening within the gemstone itself to elicit such a colourful reaction? It has to do with electrons. When electrons are excited by a source of radiation, they jump to a higher energy level around the nucleus of the atom. The excited electron remains in this excited state for a short period of time until it falls back to its original ground state. As the electron returns to its ground state, it emits energy either as heat or as visible light (fluorescence).

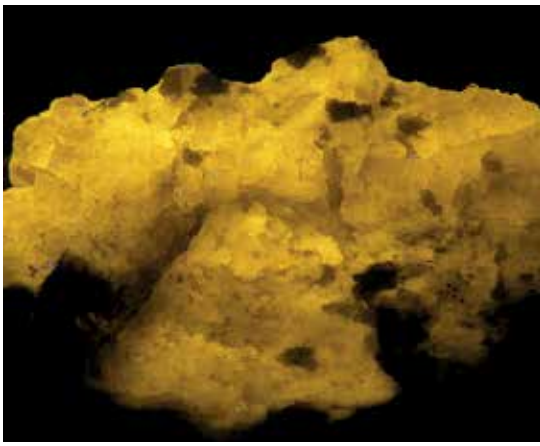
If you are wondering if all minerals fluoresce, the answer is no. Only 15% of all known mineral species exhibit this effect, the causes of which can be very complex. One of the more better-known and documented causes is the presence of activator elements that can be excited by higher energy wavelengths. Some activators include chromium (Cr), uranium (U), manganese (Mn), lead (Pb), titanium (Ti) and rare earth elements (REE). Some elements are considered to be the complete opposite, however, and when present they eliminate or quench fluorescence, causing a gemstone to be inert. Common quenchers include iron (Fe) and nickel (Ni).

HOW TO SAFELY USE UV LIGHT FOR TESTING

The types of UV light used in testing are long wave (LWUV) with a principle wavelength of 365nm, and short wave (SWUV) with a principle wavelength of 254nm. Different testing equipment ranges from UV keyrings (typically LWUV) to a UV viewing cabinet. When using UV light to test gemstones, it is important to remember that any exposure to UV light can damage your eyes, but particularly use caution when using SWUV as it is more dangerous than LWUV. Always wear protective UV goggles or ensure that your UV cabinet is installed with an eyepiece that filters out UV light.

To properly use a UV keyring, take the following steps:

- Never look directly into the light.



Scapolite from Ontario under LWUV.

- Turn off surrounding lights so you are in a dark environment.
- Place the gemstone table-down if facetted. If table up, the gemstone may reflect the UV light into your eyes and creating confusing, conflicting or inconclusive results.
- Hold the keyring approximately two inches away from the stone and, if testing multiple gems, always be consistent with the distance at which you hold the light.
- Record whether the stone is inert or fluorescing, and the strength of the reaction.

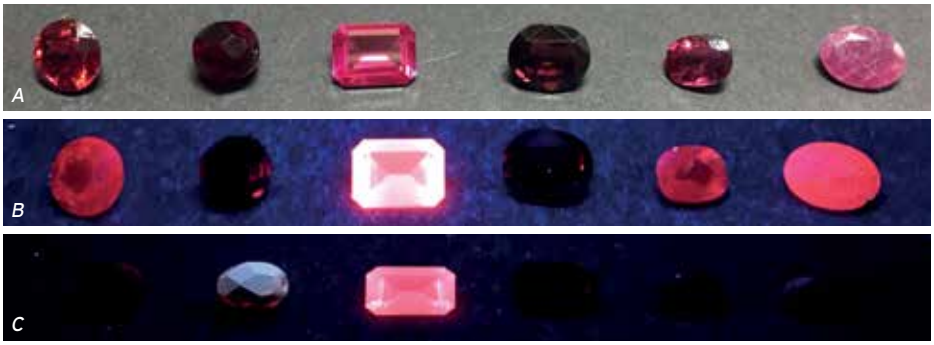
Sometimes you may see some dull purple or red light in the gemstone or on a few facet edges. This means that the gemstone is reflecting the purple UV light and is not itself a fluorescent reaction.

UNDERSTANDING THE RESULTS

While fluorescence is not a diagnostic test, and results can vary dramatically even within the same gemstone species (variable emerald results, for example), it can be a useful indication of what a gemstone is. When testing diamonds and colourless, transparent simulants, keep the below chart in mind.

Colourless Gemstones	LWUV	SWUV
Diamond (natural)	Strongest reaction, most common is blue, but can be yellow and green	Similar colours to LWUV but it is a weaker reaction
Diamond (synthetic)	Similar colours to SWUV but it is a weaker reaction	Strongest reaction, mainly fluoresce orange to yellow
Cubic zirconia	Yellow to dull-orange, variable	Weaker reaction to LWUV or inert, similar colours
Synthetic moissanite	Variable reactions	Variable reactions
Synthetic spinel	Inert	Bright, chalky white or blue/green
Paste	Inert	Variable, may have chalky white surface

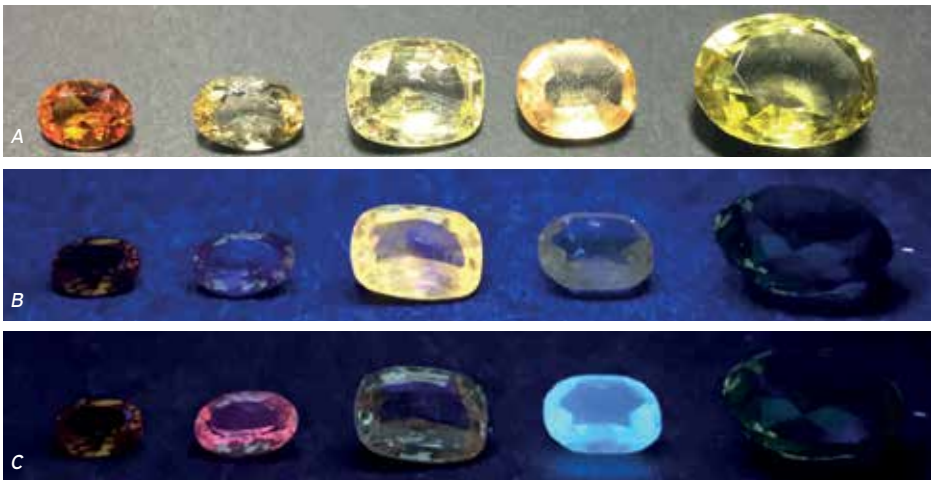
Red and Pink Gemstones	LWUV	SWUV
Ruby (natural)	Variable, strong red to inert	Same as LWUV but weaker to inert reaction
Ruby (synthetic)	Bright red, tends to be stronger than natural ruby	Red, weaker than LWUV but still brighter than natural ruby
Red spinel	Red	Red, but weaker than LWUV
Spodumene, var. Kunzite	Orange or violet	Weaker violet, whitish or inert
Almandine garnet (iron is present, this stone never fluoresces)	Inert	Inert
Red glass/paste	Inert	Variable, may have chalky white surface



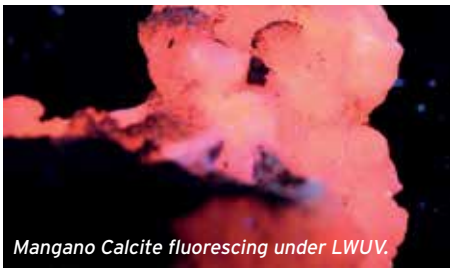
A: From L-R: Natural spinel, red paste, synthetic verneuil ruby, almandine garnet and two natural rubies. B: The same stones under LWUV. C: The results under SWUV.

L-R: synthetic flux emerald, synthetic hydrothermal emerald, natural emerald, chrome diopside.

Yellow Gemstones	LWUV	SWUV
Quartz, variety cirtrine	Inert	Inert
Yellow sapphire (natural)	Apricot orange to inert	Inert
Yellow sapphite (synthetic)	Weak red to inert	Inert
Yellow scapolite	Orangey-yellow	Reddish
Yellow topaz	Yellow/orange	Whitish



A: From L-R: Synthetic verneuil sapphire, scapolite, natural sapphire, topaz and citrine. B: The same stones under LWUV. C: The results under SWUV.



Mangano Calcite fluorescing under LWUV.

When testing red to pink gemstones, the top left chart can be helpful, though do keep in mind that natural rubies in particular may have variable fluorescence based on their iron content. If iron is present, the ruby will have minimal to no fluorescence. Synthetic rubies tend to have much stronger fluorescent reactions.

When testing green gemstones, fluorescence can be tricky to use for identification purposes. However, it may be useful in terms of recognising the presence of fillers in emeralds or green jadeite jade, for example. Some resin fillers fluoresce a whitish colour under LWUV and if this reaction is seen in either of the aforementioned stones, it may be an indication that filler is present, especially if the fluorescence is concentrated in seams or certain areas rather than being evenly distributed across the stone.

Note the natural emerald fluorescing a whitish colour (second from right), hinting that a resin filler may have been used. Further testing will be needed to confirm this possibility.

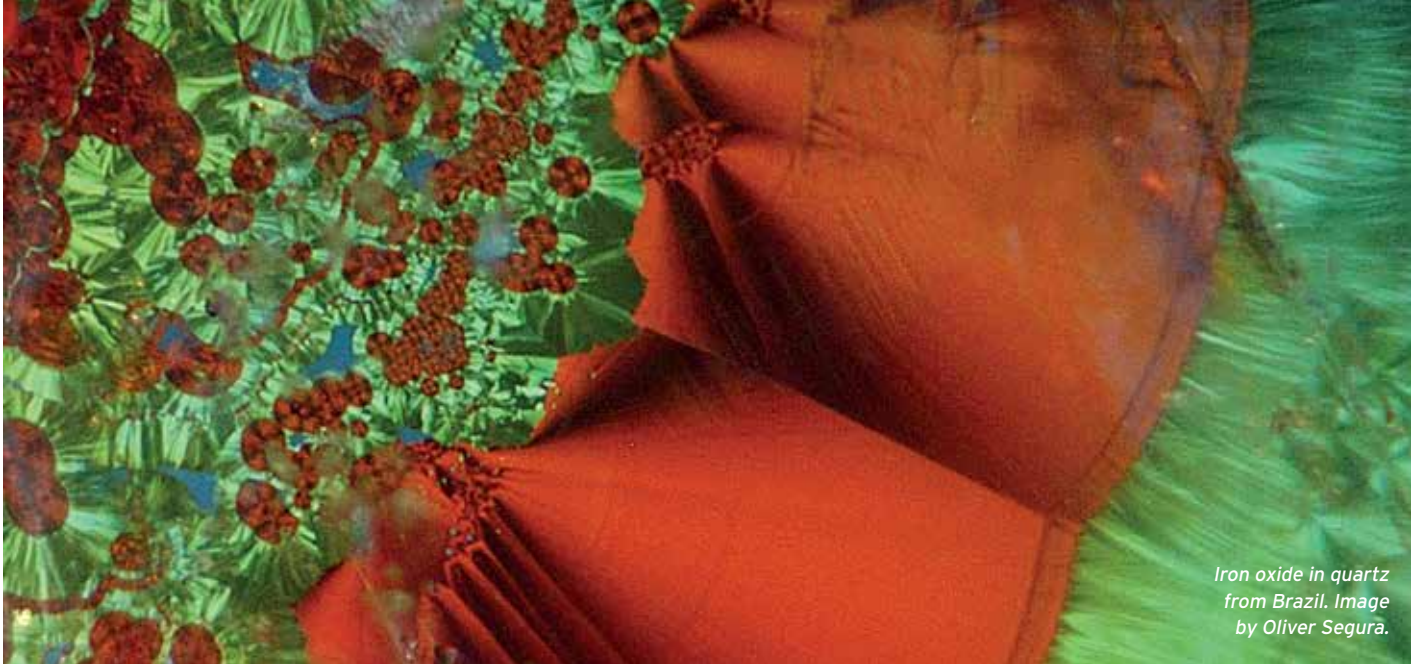
Additionally, natural emeralds, if they do fluoresce, will have a red to inert reaction under LWUV, and a weaker inert or green reaction under SWUV. Synthetic emeralds may fluoresce red or, in the case of the synthetic hydrothermal emerald (centre image, second from the left), they may be inert if doped with iron to imitate a natural inert reaction. Untreated green jadeite does not fluoresce, so any other reaction should be regarded with suspicion and further testing will be needed.

When testing yellow gemstones, the bottom left chart may prove useful.

CONCLUSION

As is evident, fluorescence can be a helpful tool when testing gemstones, though not always diagnostic. It is a quick test that is one of the more exciting ones in the world of gemmology. ■

All images courtesy of Lily Faber and Gem-A gemmology tutor, Pat Daly.



Iron oxide in quartz from Brazil. Image by Oliver Segura.

GEMSTONE PHOTOGRAPHER OF THE YEAR 2018

Have you got what it takes to be Gem-A's gemstone photographer of the year?

Enter Gem-A's Photographer of the Year 2018 competition and you could be in with a chance of winning a year's free membership and a *Photoatlas of Inclusions*.

There are three categories for entry:

The Internal
Including photomicrography, gemscapes and unusual inclusions

The External
Unusually cut or faceted gemstones, carvings and *objets d'art*

The Humanity in Gems
The life around gemstones, including mining, dealing, gemmologists at work or studying

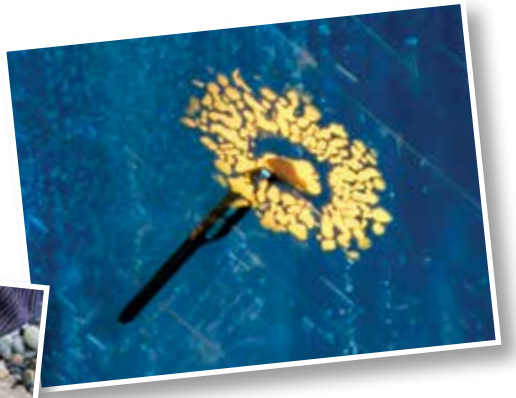
SUBMISSIONS

Members and current students of Gem-A only. Please submit all entries to *editor@gem-a.com*, specifying your membership or student number and category of entry. Please send files larger than 10mb via Dropbox or WeTransfer. Closing date for entries is Friday August 31, 2018.

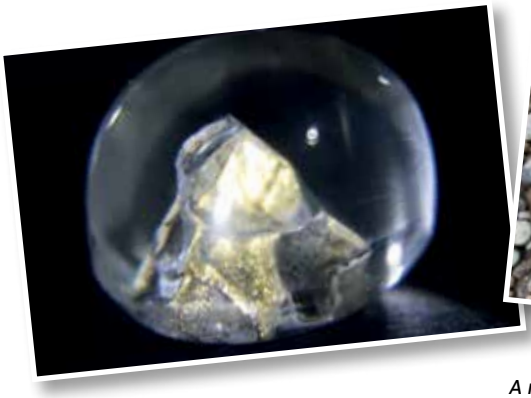
WINNERS

A Member Award and a Student Award will be given. Honourable mentions will also be given for each category. Winners will be announced at the 2018 Gem-A Conference.

Liftoff: Gilalite in Quartz. Fiber optic illumination. Field of view 3.57 mm. Image by Hollie McBride.



"Dandelion flower in sapphire". Growth blockage with thin film rosette in Sri Lankan sapphire using modified Rheinberg illumination, Field of view 1.34 mm. Image by Jonathan Muyal FGA.



Pyrite crystal in Feldspar cabochon, Myanmar. Image by Jon Mehdi.

A miner holds up a small nephrite boulder that he dug from the river in China's Xinjiang province. Image by Billie Hughes FGA.

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

Could a nut replace an elephant?

1: Two polished tagua nuts showing how the colour alters with age. Back: about twenty years old. Front: a new nut.

Gem-A President Maggie Campbell Pedersen FGA looks at ivory palm nuts and considers whether they could be used as an alternative to elephant ivory.

2: Tagua nuts showing, left to right: the husk, the husk partly removed by polishing, a polished nut, a broken nut.

Could a nut possibly replace an elephant? The answer (in a nutshell), is no, but the nuts, or seeds – often referred to as 'vegetable ivory' due to their superficial resemblance to ivory – are a valuable organic material in their own right.

Ivory palm nuts have been found in Egyptian tombs dating back about 4000 years (though their purpose there is unknown). In Europe and North America during the mid- to late-nineteenth century, they became a popular material for the manufacture of small items such as sewing requisites, chess pieces, umbrella or cane handles and toys, but their main use was in the button industry. At one time about 2 million nuts were being imported into England annually for the button trade. The nuts' usefulness and popularity faded with the advent of early plastics, but today they are enjoying something of a renaissance due in part to the idea that they can replace elephant ivory and thus help to save the elephant.

It is true that the nuts when fresh have a colour very similar to ivory, and that they can also be carved, turned on a lathe, stained, and made into many of the same small items as animal ivory, but their limited size and the fact that they tend to lose their creamy colour with age and turn a woody beige means that they can never be a true substitute (**1**). Today carvings are sometimes coated with a clear lacquer to prevent this happening.

Various types of nuts have been carved for use in the decorative arts, but the best known and most abundant is the tagua or corozo nut which comes from various South American countries, notably Equador. There are two main species, both belonging to the genus *Phytelephas* which, literally translated, means elephant plant. The palms have very short trunks and long fronds, with the fruit growing just beneath the fronds. Around twenty nuts can grow in a single large fruit (**2**).

In Micronesia there can be found a different ivory nut palm, the Polynesian or Caroline nut, of the genus *Metroxylon*, which bears a single-seeded fruit. These are now being cultivated for sale, though in far smaller quantities than the South American nuts. The doum palm (*Hyphaene*) grows in Africa and produces fruit containing a single nut with a central cavity. It is sometimes called the 'gingerbread nut' as the juicy pulp of the fruit encasing the nut has a taste reminiscent of gingerbread. It is also used as vegetable ivory but is not gathered in large quantities. Attempts at cultivating ivory nut palms in places such as Florida have so far not been successful.

The nuts can vary but equate in size roughly to that of a chicken's egg. They are made up of cellulose, a complex carbohydrate, which is an important structural component of all plants. Each

3: A Victorian sewing needle case made from two tagua nuts, discoloured with age.

4: Four modern tagua nut netsukes carved in China. The one on the left has been coated to prevent it from discolouring.

creamy-white nut is covered by a thin, brown husk, which is partially or entirely polished away before the nut is worked (**3**).

When fresh, the nuts consist of an almost clear liquid which solidifies to a translucent jelly-like substance and, in turn, hardens to become a workable material. The nuts must be completely dried before any carving or cutting can be done, and are sometimes fumigated as well to ensure that no small insects are left alive inside to eat the finished article. Nonetheless, it is not unusual for dried nuts to have to be discarded during cutting as many crack in the centre when drying, and the cracks cannot be seen before the nuts are worked.

5: Detail of cut ivory nut, showing the structure of the cellulose.

6: Left: a Victorian carved and partially coloured button. Right: modern dyed button, showing the moiré silk effect caused by the nut's structure.

Ivory nuts can take fairly intricate carving, so several nuts can be joined together by a thread as can be seen in the illustration of the needle-case (**3**). They are easily dyed or painted, and some of the husk is frequently retained in a finished item as part of the decoration.

Use of the nuts is being encouraged in countries such as China, where new trade bans mean that former ivory carvers will have to find alternative materials to carve. The most popular items made there are netsukes for the tourist trade (**4**).

Vegetable ivory buttons are still being manufactured for high quality garments. Today, any intricate carving no longer has to be carried out by hand as ornate buttons can be produced using lasers. Other decorative effects are singeing or cracking parts of the surface. Although mostly used for inexpensive jewellery in the form of beads, expensive examples can also be found of delicately carved vegetable ivory mounted in gold.

Vegetable ivory has a similar, chalky blue fluorescence to real ivory, but thanks to the structure of the cellulose it should not be difficult to identify vegetable ivory and the two are seldom confused. Viewed with a 10x lens under good light, the plant cells appear as minute dots of equal size. In some instances it is possible to see that they are in fine concentric lines. Due to the structure, dyed objects often display a wavy pattern similar to that of moiré silk. (**5** & **6**)

It used to be suggested that a sure test for vegetable ivory is a drop of sulphuric acid on the surface, which after a few minutes will produce a pink stain. This, however, would be an extremely destructive test as the nuts are porous and the acid will penetrate deep into the material, making it impossible to remove the spot by polishing. Furthermore, in a sufficiently strong solution the acid could dissolve the nut completely. If accurate identification of an item is impossible by sight, it is best to test it by FTIR in a laboratory.

7: A modern tagua nut bracelet produced in South America.

Vegetable ivory is more difficult to carve than real ivory, although officially its hardness on Mohs's scale is not dissimilar. It would never be possible to carve it as finely as elephant ivory. So could tagua nuts replace true ivory? No, but they do make an excellent alternative medium with which to work, as the nuts have many possibilities and are very attractive. The ultimate bonus is that they are a renewable resource and give employment to local populations, and subsequently they are helping to protect the rainforest (**7**). ■

All about Arkansas

James Zigras, owner of Avant Mining.

Following a successful start to 2018 at the Tucson gem shows, Avant Mining owner, James Zigras, explains more about his quartz crystal mines in Arkansas, USA, the growing popularity of wavellite, and the wonderfully-named Mona Lisa Mine.

1: The McEarl Mine was acquired by Avant Mining in 2010.

What is the story behind Avant Mining?

I founded the company in 2009 when I purchased the well-known wavellite and variscite lease at Avant, Arkansas. Interestingly, the host rock is the same novaculite formation that hosts the Mona Lisa turquoise mine. I had no ambitions of mining quartz and wavellite, however, it all magically fell into place when, in 2010, I had the opportunity to purchase the McEarl Mine, known amongst connoisseurs as the finest quartz crystal locality in the world (**1**). I then began to purchase many other mines, eventually amassing nearly 12,000 acres of mineral properties.

What are the locations of your mines and what challenges do you encounter?

The quartz crystal mines (there are 28) are located in Garland, Saline and Montgomery counties in Arkansas. The main challenge for me and any other artisanal gem and/or crystal mining company is finding the right group of qualified miners. Mining crystals and gemstones is an apprenticeship-type of training. Most of my miners have been mining since they were young.

2: This flawless optical quartz, known as 'The Cactus Quartz', was also discovered at the Zigras Mine in Blue Springs, Arkansas. It captured the attention of collectors at the Tucson gem shows in 2017.

What makes Arkansas in particular such a key location for quartz mining?

It hosts one of the largest quartz crystal belts in the world that stretches from the capital of Little Rock all the way into eastern Oklahoma.

3: The Mona Lisa Mine is famed for its turquoise.

What are some of your most interesting or exciting discoveries?

'The Crystal Vortex' was discovered at the Zigras Mine in 2014. This find is ongoing and is the largest documented discovery of high-quality quartz crystals ever found. The tube of crystals is currently 50 metres long and is still being excavated (**2**).

What can you tell us about the Mona Lisa Mine?

The Mona Lisa Mine is special for many reasons. Firstly, it is the only turquoise mine in eastern USA. Secondly, it has produced the largest nugget on record for the USA (246 lbs currently in Avant's company collection). Thirdly, it produces an exceptional array of colours from the finest 'sleeping beauty' blue to yellows and greens (**3**). Avant recently re-opened the mine (December 2017) under limited scope as more exploration is being conducted to determine how to best mine the deposit.

Turquoise and quartz have long histories in jewellery, but wavellite is perhaps less well known – do you plan on promoting this particular gemstone and has there been any increased interest in recent months?

Wavellite interest has surged after the most prominent cab dealers in Tucson sold out of their inventory. Avant plans on re-opening the [de Linde] mine this summer so large production can be shown at Tucson 2019.

Have you noticed any key trends in the market recently?

Crystals are becoming more popular than ever due to social media and celebrity interest. The demand seems to be growing at a fairly rapid pace with no signs of slowing anytime soon. Also, there is more mine-to-market demand where consumers want to know crystals or gems are sustainably and ethically mined. This kind of uplift is definitely increasing in the US markets. ■

Striking wavellite specimens, including a finished jewellery piece.

All images courtesy of Avant Mining LLC and James Zigras.

GEM-A & NAJ FIELDTRIP 2018

Following its success in 2017, Gem-A and NAJ have teamed up again to offer an incredible fieldtrip to Sri Lanka, accompanied by gem experts Colin and Hillary Winters

DATE: 1-16 OCTOBER 2018

COST: £2350 (COST MAY CHANGE DEPENDING ON SINGLE OCCUPANCY)

CONTACT: FOR MORE INFORMATION PLEASE CONTACT LINDSEY.STRAUGHTON@NAJ.CO.UK

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

The NATIONAL ASSOCIATION of JEWELLERS

MEMBERSHIP

Are you looking for an exciting new challenge?

Apply now for upcoming FEEG Diploma exams in 2018

The Federation for European Education in Gemmology (FEEG) was set up in 1995 by several gemmology institutions to create a pan-European gemmology qualification that would be recognised by all bodies and institutions across Europe.

The FEEG Diploma is built from the collective knowledge of Europe's top gemmological training centres, and challenges trained gemmologists' theoretical and practical knowledge of over 100 stones, from the everyday gems to the lesser known minerals. As a founding member of the FEEG Diploma, graduates of Gem-A's Gemmology Diploma are eligible to apply for the exam.

FEEG
FEDERATION FOR EUROPEAN EDUCATION IN GEMMOLOGY

Exam Location:
Gem-A headquarters

Qualification:
EG (European Gemmologist)

Entry Requirements:
Gem-A Gemmology Diploma

Assessment:
One theory paper
One practical paper

Examination Fee:
£300.00

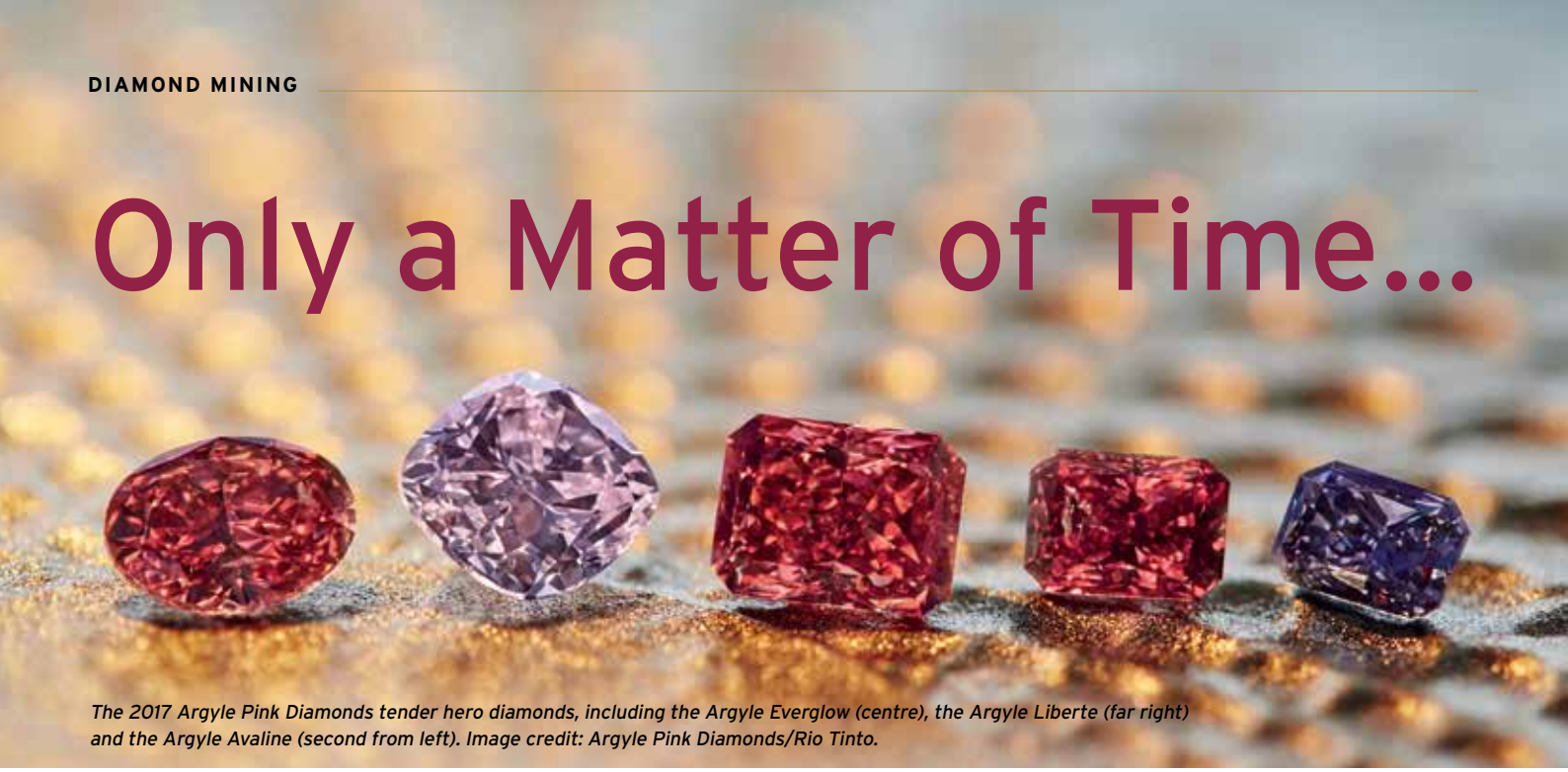
2018 Exam Dates:
3 July 2018
9 October 2018

Optional Study Days (Gem-A HQ):
2 July 2018 – £90
8 October 2018 – £90

NEW!
3-Day Workshop:
27-29 June 2018 – £450 (members)
or £600 (non-members)

Visit **feeg-education.com**
or email **education@gem-a.com**
to apply today

Only a Matter of Time...



The 2017 Argyle Pink Diamonds tender hero diamonds, including the Argyle Everglow (centre), the Argyle Liberte (far right) and the Argyle Avaline (second from left). Image credit: Argyle Pink Diamonds/Rio Tinto.

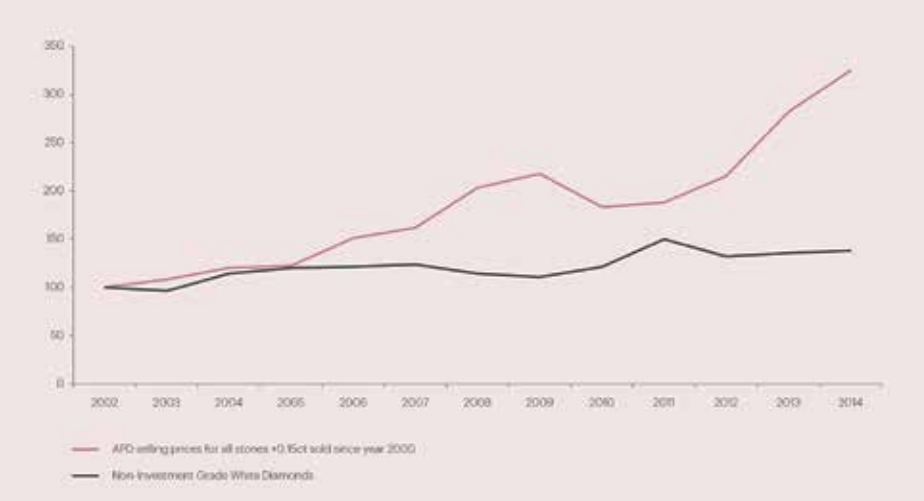
In March, Rio Tinto released its 2017 annual report highlighting significant changes to its estimates of ore reserves and mineral resources at its Argyle Diamond Mine in East Kimberley, Western Australia. With operations expected to cease by 2020, *Gems&Jewellery* assesses what impact this might have on the pink diamond market, including demand, supply and pricing.

What happens when a mine runs out? As is typical with the global diamond mining industry, the answer is complex and subject to various factors, like technical advances, financial performance and ethical concerns. Earlier this year, Rio Tinto announced that Argyle ore reserves decreased by 13Mt (megatons) from 29Mt to 16Mt in 2017. This decrease includes the depletion of almost 5Mt due to production activities in 2017. A media statement from March 2018 read: "The balance of the reduction results from a more conservative view on future production performance, grade and economic shut-off criteria." In reality, this means the Argyle Diamond Mine's remaining reserves will underpin its operation only until 2020.

PRECIOUS PINKS

Mine closures are nothing new. In fact, more attention in recent years has been focused on the ethical, environmental and moral obligations that a miner has during the shut-down process. However, the Rio Tinto Argyle Diamond Mine in East Kimberley, Western Australia, has a special reputation for its exceptional pink diamonds, as well as a handful of spectacular reds and violets. In 2017, the Argyle Pink Diamonds Tender presented 58 rare diamonds, including a 2.11 carat fancy red diamond named the 'Argyle Everglow'. The lot was eventually won by New York-based Optimum Diamonds LLC, which also walked away with the Argyle Liberte – a 0.91 carat violet diamond. The largest pink diamond in the 2017 tender, the 2.42 carat Argyle Avaline, was purchased by international luxury jewellery house, Graff.

This high-brow scrum to secure the finest pinks is made all-the-more exciting by the fact that Rio Tinto's Argyle Mine produces virtually the world's entire supply of pink, red and violet diamonds. And, of the diamonds it mines, less than 0.1% have these coveted colours. When considering this in the context of world auction results, it is clear that the appetite for coloured diamonds, especially pinks, is only increasing with time. Take for example the Pink Star,



A graph highlighting the sharp price increases for Argyle Pink Diamonds in comparison to white diamonds since the year 2000. Image credit: Argyle Pink Diamonds.
Data Source: www.polishedprices.com, Gemdax Consultants; Argyle Pink Diamonds.

A SPARKLING HISTORY

We explore some of the finest and most exceptional pink diamonds that have even been discovered, or sold at auction.

The Agra
At 32.24 carats, this diamond first appears in history in 1526 when the first Mogul Emperor, Balbur captured the city of Agra, India. Experts suggest it may have originally been as large as 40 carats. In its last public appearance in 1990, the Arga sold for £4.07 million.

Darya-i Nur
The 'Sea of Light' of the Iranian Crown Jewels was estimated in 1827 to weigh between 175-195 carats. Mined from the ancient Golconda mines of India, this rectangular step cut stone is one of the largest pink diamonds in existence.

Nur ul-Ain
Known as 'Light of the Eye', this drop-shaped oval brilliant-cut of approximately 60 carats was set in a tiara for Her Imperial Highness Empress Farah Pahlavi of Iran by Harry Winston.

The Williamson
A 23.60 carat round brilliant-cut pink diamond gifted to Queen Elizabeth II on her wedding day. It was discovered in 1947 in Tanganyika, Africa, by Dr John Williamson. The diamond was later set into a brooch designed by Cartier.

Sweet Josephine (above)
At 16.08 carats this incredible cushion-shaped fancy vivid diamond sold at auction for £18.8 million at Christie's Geneva in 2015.

Pink Promise (left)
This 14.93 carat fancy vivid pink diamond sold at Christie's Hong Kong in November 2017 for £24.1 million. At £1.6 million ($2.14m) per carat, it is the second most expensive pink diamond ever sold.

a 59.60 carat fancy vivid pink diamond that became the most expensive gem ever to be sold at auction in Hong Kong in 2017, securing US $71.2 million.

2020: WHAT WILL HAPPEN NEXT?

Chris Soklich, director of end-to-end coloured diamond investment services company, Australian Pink Diamonds, believes the Argyle Diamond Mine closure will have an impact both in the medium- and long-term. "As an investment opportunity, coloured diamonds have an astonishing potential for long-term returns. This is due to a growing imbalance in the supply demand equation," he says.

"The announcement from Rio Tinto that the Argyle Mmine will cease operations for diamond mining in 2020 caused a stir amongst investors. This closure positions the 'Argyle Pink Diamond' as an investment opportunity offering significant capital gains in the medium-term."

Pink diamonds are the most in demand, but it is important not to forget East Kimberley's more abundant shade: brown. Fortunately, these rich hues of cinnamon, cognac and chocolate are more 'readily' available in other global locations. Soklich says: "The Argyle Mine diamond production equates to roughly 72% brown, 27% near-colourless and less than 0.1% pinks. Although being one of the largest mines [by volume] in the world, the closure will have little effect on the other colour diamond markets, simply because there is no shortage of brown or near colourless diamonds."

In the long-term, many believe that the name 'Argyle' will become a prized nominal, similar to Burmese, Kashmir and Golconda. Miriam Chen, chief executive officer of The Fancy Color Research Foundation, comments: "It is very hard to predict what will happen with the pink fancy color diamonds from Argyle once the mine closes. However, we could look at the price evolution of rubies originated from Burma and how they became an incredible investment to those who bought them across the years."

There is currently no evidence to suggest that a new mine has, or will, be found that can fill the gap that the Argyle Mine leaves behind. Soklich notes: "While occasional pink diamonds can be found in other mines, such as Brazil, Russia, and Africa for example, the Argyle Mine is unmatched in the sheer quantity and quality of the pink diamonds it has produced over the years."

And even if tantalising evidence suggests that pink diamonds may be present elsewhere, the financial and operational implications could make extracting them impossible. For future generations of gemmologists, the pink diamond could simply captivate from the pages of a text book, or from behind a thick pane of glass. Owning one will transform from the improbable to the impossible. ■

Images (A Sparkling History) courtesy of Christie's.

Examining a pink diamond.
Image credit: Australian Pink Diamonds.

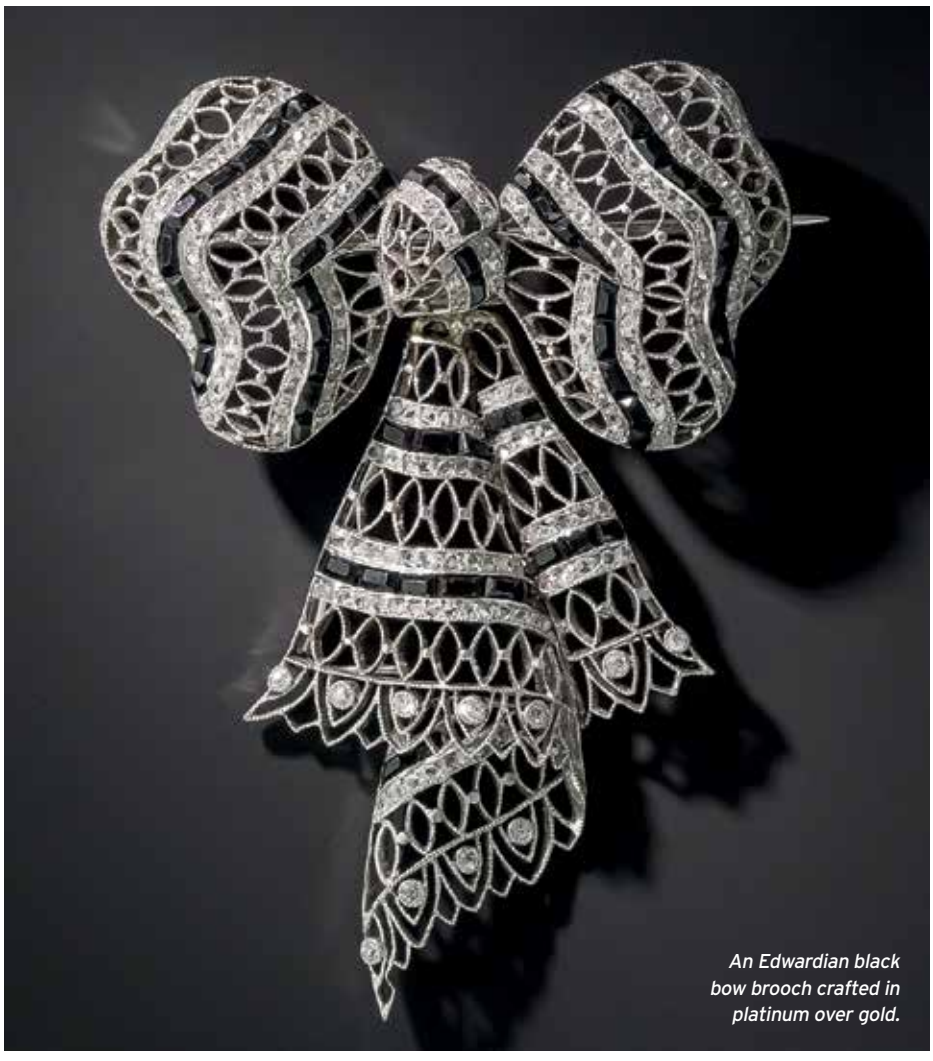
THE PAST AND PRESENT OF PLATINUM

As a gemstone and jewellery grading and identification expert at Lang Antiques in San Francisco, Starla Turner FGA GG has seen her fair share of exceptional pieces, both historic and contemporary. Here, she delves into the history of platinum and explores how it has influenced jewellers since the 1700s.

Our illustrious platinum jewellery evolved from scientific discoveries: unmeltable light bulb filaments, corrosion-resistant vats, and inexpensive, shapeable false teeth. In the 1700s the alluvial, heavy white metal from Ecuador was christened 'platina', or little silver.

A curious metal, the small particles were rollable and forgeable (shaped by compressive blows) into solid wearable jewellery, but not meltable. To join the tiny pieces, early metalsmiths coated and fused them with melted gold. Platinum was inconsistent; it was workable but often cracked. Why? A natural piece of platinum is often an aggregate of the six platinum group metals. Three are used for constructing jewellery: platinum, iridium, and palladium, and three mainly used for industry: ruthenium, osmium, and rhodium (plating that resists scratching and tarnishing). They are 'noble' metals: nonferrous, highly stable chemically, and resistant to oxidation and corrosion from acids. Each metal has a different hardness, density, ease of bending and shaping (malleability), ease of drawing into wire (ductility), and resistance to breaking under tension (tensile strength). They are a 'dead' metal with little spring back memory. When forged or rolled as a unit, the mosaic of metals resulted in an inconsistent, patchwork solid, hence the cracking.

Scientific communities of the 1800s identified and separated out each metal using various acid solutions and temperatures. Immersing the platinum aggregate in hot aqua regia – a combination of nitric and hydrochloric acids – actually dissolved the platinum component. Once precipitated out of this solution and dried into a 'sponge' the pure platinum was ground into powder, cold compressed, high-temperature heated (sintered) and forged into a workable solid bar. During this sintering process, each overlapping atom develops ragged edges that mingle to form a physical bond and create a solid that can be forged and rolled into objects. This 'powder metallurgy' took decades to evolve into an efficient process. Still, pure platinum was soft and considered easily 'scratched'. Typically, a platinum scratch is usually a compaction dent with little or no metal lost. A gold and platinum alloy



An Edwardian black bow brooch crafted in platinum over gold.

joined pieces as no efficient platinum melting method was known.

Transferrable technology increased platinum's usefulness. In 1839 Goodyear developed vulcanised rubber useful for airtight, hot, higher-pressure torch hoses and casting molds. In the 1850s, George Matthey and Wilhelm Hereaus's oxy-hydrogen blowpipe techniques finally melted larger quantities of platinum at approximately 1,768 degrees Celsius and the 1901 invention of the super hot oxy-acetylene torch did it even faster. These tools and fuels created a safe, economical, direct, hot flame.

Dentistry advancements in alloying of iridium and platinum for strength, and the refinement of the lost-wax casting system for mass production adapted well to jewellery. Adding 5-10% iridium – a similarly coloured, bright white, strong, workable, and hard (Mohs approximately 6.5) metal – to 90-95% pure platinum created a wear resistant, white metal.

For the all-white look, metalsmiths needed platinum-to-platinum joins. Brazing, often called soldering, used a low melting point, unifying filler (solder) of gold, silver, and platinum that diffuses into the platinum along the grain boundaries, without melting the pieces being soldered together. Platinum, not a strong thermal conductor, stays cool except at the torched area, but a methodical assembly process of pre-polished parts is necessary to retain the pieces' integrity and clean finished look. Typically the 'solder' differs in colour, hardness, and strength relative to platinum and care is needed to prevent over polishing the softer solder seams leaving ridges. The join is visible, often greyish from oxidation or yellowish from the gold (**1**). Either sawing out a single solid piece to minimized the colour seam differences or creating the smallest, strongest joins were critical to beauty.

Finally everything was in place to make all-platinum jewellery: One problem... no demand!

In the 1880s, the reigning white jewellery metal was silver. The advantages of the white colour, low melting point, abundant supply, and workability outweighed silver's tendency to tarnish and the need for expensive gold backings for strength. Gold and silver easily dissolved into each other creating a strong bond and secure setting for the abundant, newly-showcased South African diamonds. It wasn't ideal. The silver layer was thick and heavy to secure the valuable diamonds and the tarnish darkened the diamonds and stained clothes.

On the cutting edge, in 1890, Cartier introduced all platinum, luxury jewellery in its iconic garland style. Cartier's secret platinum alloy revealed a white shimmering surface. According to *Cartier, Jewellers Extraordinary* by Hans Nadelhoffer (1984), this was achieved through "millegraining 'demetalized' platinum, dotting edges into glistening reflections of light that encircled diamonds".

> PLATINUM'S STRENGTH ALLOWED FOR... KNIFE EDGED FRET WORK, MILLEGRAINING, DELICATE PRONGS, AND BEADS INTEGRATED INTO FINELY PIERCED PATTERNS.

1. Examples of seams and visible joins on die-struck platinum jewellery.

From the mid-1800s, this silver over gold necklace is set with a pear-shaped pink diamond.

Iridium platinum had the perfect hardness and malleability for hand fabricating Cartier's popular elements: light and lacy scrolls, flowers, bows, and hearts. Platinum's strength allowed for enduring light and delicate hand-fabrication with knife edged fret work, millegraining, delicate prongs, and beads integrated into finely pierced patterns. Finer work, with thinner shanks, and stones set closer together with smaller almost invisibly set prongs, kept the pieces strong yet light in look and lighter in weight, perfect for highlighting diamonds. Platinum's deadness made setting diamonds easier and faster. The stronger prongs, pushed down once, stayed securely in place — a bonus for those new to working with platinum.

By the late 1800s England's Edwardian era was ripe for Cartier's light, sheer, pastille, and feminine jewellery designs. To improve strength, gain acceptance and add prestige to jewellery, platinum was sintered, rolled, or brazed over a

An all-platinum emerald and diamond brooch.

> THE CENTURY OLD HEIRLOOMS WE SEE TODAY ARE A TESTAMENT TO THE ENDURING PROPERTIES OF PLATINUM.

layer of gold using existing silver over gold technology. The tenuous bond between gold and platinum, due to different expansion and concentration temperatures, created stress, brittleness and gaps wherever the two diffused and interfaced. Nonetheless, platinum over gold, garland style and foliate patterned jewellery prevailed with technology and tradesmen's capabilities seguing to all-platinum jewellery by early 1900.

Platinum demand surged. Fashion, worldwide media and huge new South African and Canadian mines fuelled the Art Deco black and white architectural look. Important European jewellery was fabricated in platinum, the brooch popularity swam in platinum, and the openwork 'filigree', light airy, die-struck designs ignited the North American market. Here, some of the world's largest jewellery manufacturers supplied the masses. The 33% increased density of platinum die-struck pieces, relative to gold, produced an attractive higher lustre as well as increased strength and durability. Platinum's higher cost (from being 60% heavier than gold) was offset by thinner, finer jewellery. Though platinum could be melted and cast, hand-fabrication for fine jewellery and die striking for mass production were the prevalent techniques. Platinum ruled!

In North America, during World War I and II, platinum was deemed a strategic metal used for rifle and engine parts, explosives and the making of armaments. It was forbidden in jewellery. Alternatives were needed. The war hardships distracted most from the overlooked and underused 1915 patent for white gold (gold, palladium and zinc). In 1920, Belais Company patented, trademarked, branded and heavily advertised a popular 18K white gold. Well-received, lightweight, filigree, die-struck pieces were rapidly produced and at a lower cost than platinum. Until the onset of World War II, platinum dominated the higher-end worldwide jewellery market with white gold popular for coloured stone and smaller diamond pieces in the USA, and yellow gold popular in the UK. In 1942, during WWII, palladium became a stand-in for platinum. While lighter, harder and white, its demand fizzled post war. By the 1950s all-platinum jewellery roared back.

The century old heirlooms we see today are a testament to the enduring properties of platinum. Platinum metals were created during the supernova explosions, formed by nuclear fusion, and dispersed into clouds that our earth formed in. Look down, a material that was created by the Big Bang now resides on your finger. ■

ACKNOWLEDGEMENT

Precious metals management company, Johnson Matthey, has written and compiled the most comprehensive modern and historical articles on platinum, often based on its founders' experiments and experiences, and graciously and freely shares the knowledge on the web and in books. I am forever grateful.

A complete list of sources is available upon request. All images courtesy of the author and Lang Antiques.

A three-loop Edwardian bow brooch in platinum over gold.

MARCUS MCCALLUM FGA

PRECIOUS STONES, BEADS & PEARLS

A wide range of precious and semi-precious stones,
beads and freshwater pearls, personally selected
from around the world.

Unusual stones a speciality.

ROOM 27-31, NEW HOUSE
67-68 HATTON GARDEN, LONDON EC1N 8JY
TELEPHONE: +44(0)20 7405 2169
FACSIMILE: +44(0)20 7405 9385
email:info@marcusmccallum.com
www.marcusmccallum.com

Investigating FAKE ROUGH

Gagan Choudhary FGA, deputy director of Gem Testing Laboratory Jaipur, describes various types of fake gem rough that has passed his desk in recent months, including mica rock presented as emerald rough, cubic zirconia and topaz fashioned as diamond octahedrons, and synthetic quartz mimicking aquamarine.

1: This 1075 gm micaceous rock was embedded with elongated 'hexagonal' crystals of artificial glass (marked with arrows). Note the difference of texture around embedded crystals and rest of the rock.

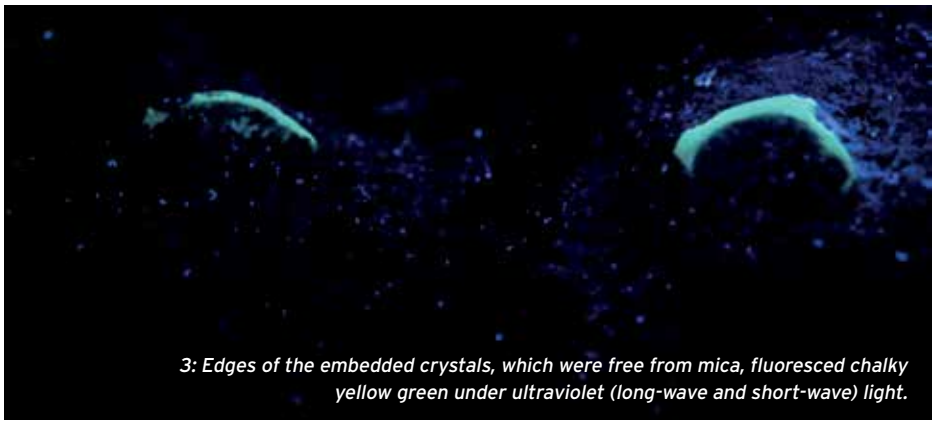
2: Under transmitted fibre-optic light, the embedded crystals appeared bright green, raising suspicion about their origin. Note the granular texture around embedded crystals.

Reaching directly to the miners for procuring rough has always been profitable, but involves a huge amount of risk unless one has enough experience in buying at the source, deep knowledge about the stone being purchased, and handling the pressure thereof. Often, there have been cases when dealers tend to forget the possibilities of scams and frauds at mining sites or the markets nearby. The sellers at such locations often present glass, synthetics, treated gems or other cheap natural materials as expensive gems in order to make some quick money. This practice has been prevalent at most of the major mining regions around the world for decades. At Gem Testing Laboratory Jaipur, we routinely encounter such cases, some of which are presented here.

GLASS-FILLED MICA-ROCK, PRESENTED AS EMERALD ROUGH

Recently, a 1,075 gm black micaceous rock was presented for identification (**1**), a true example of a fraudulent rough, which, although not shocking to us, was definitely an interesting one. Initial observations with unaided eyes from different angles suggested the presence of several crystals, with hexagonal profile, embedded in the rock. Such rock formation is a common sight for those dealing in emerald rough, especially from locations where emerald is associated with mica (phlogopite) schist, such as Zambia.

Careful observation using strong fibre-optic light surprised us. Under reflected light, only small areas or corners of the embedded crystals appeared green. The rest appeared dark, due to the presence of black mica on and around crystals. However, when light was transmitted through these crystals, they appeared bright green (**2**), which raised suspicion about their origin. Such bright green colour under transmitted light, especially in an embedded crystal, had never been seen before. Further examination revealed a granular texture around these embedded crystals, while the rest of the rock appeared flaky (**1** & **2**); this supported our suspicion. These features suggested that micaceous rock was first drilled, filled with green 'hexagonal' crystals artificially, and then the joints were covered with a mixture of glue and black mica. When observed under ultraviolet light, corners of the embedded crystals (mica-free areas) fluoresced chalky-yellow green (**3**). Raman analysis confirmed these embedded crystals as artificial glass.



3: Edges of the embedded crystals, which were free from mica, fluoresced chalky yellow green under ultraviolet (long-wave and short-wave) light.

MICA-COATED GLASS IMITATING EMERALD ROUGH

Another form of emerald-rough imitation are these mica-coated glass (**4**). In this case, pieces of green glass are first fashioned in the shape of hexagonal rough, which is then coated with fine powder of black mica mixed in glue, followed by a layer of mica chips. These worked-up pieces are then taken to the mining sites by the middlemen and mixed in parcels of low-quality natural emeralds. The illustrated glass specimens here were seen in a parcel of emeralds from Jharkhand, India.

4: These glass samples are worked-up to imitate emerald rough, by fashioning into hexagonal crystals and coating with black mica; these were found mixed in a parcel of natural emerald.

SYNTHETIC RUBY FROM MOZAMBIQUE

We came across a small parcel of rough rubies (five pieces, weight range of 3.60 - 18.06 ct) submitted for identification (**5**). All the specimens were tumbled with a corroded surface and interestingly coated with a yellow-brown substance. Most of the samples were free from inclusions, but under immersion microscopy all displayed curved growth lines, characteristic of synthetic ruby grown by Verneuil process. Appearance of these specimens clearly suggested that they were presented as natural. Prior to this we have seen many more specimens of synthetic ruby, and in much larger sizes, presented as natural. As per the discussion and information from the depositor, these stones were purchased in Mozambique.

5: These rough specimens weighing 3.60 - 18.06 ct were identified as synthetic ruby. Similar synthetic samples in larger sizes were also encountered earlier, which were said to be purchased from mining areas in Mozambique. Also note the presence of yellow-brown substance on extreme right specimen, imitating mud on natural rough.

> The sellers... often present glass, synthetics, treated gems or other cheap natural materials as expensive gems in order to make some quick money.

NATURAL AND SYNTHETIC RUBY COMPOSITE

This 28.73 ct bright red rough, associated with some black and white minerals, was presented as a natural ruby. Upon initial examination with unaided eyes, the surface displayed some areas of milky angular zones against a pinkish to purplish background, typically seen in natural ruby crystals (**6a**). When examined under transmitted light, a large central area of the specimen appeared bright red, while the edges appeared dark and opaque (**6b**). This raised suspicion about the origin of this rough.

Careful examination under the microscope revealed a sudden change

6: This bright purplish red-pink rough (6a left) is a composite made up of synthetic and natural ruby. The central part is a synthetic ruby while the outer part is composed of chips of natural ruby. Note the small areas of angular milky zones. Under transmitted light (6b right, central synthetic part of the specimen appeared bright red, while the edges appeared dark and opaque.

7: Presented as natural sapphire, these specimens (a & b) were turned out to be synthetic. These were presented as broken, tumbled rough (7a top, and as fashioned, well-formed hexagonal-pyramidal crystals with surface markings (7b above).

of growth and inclusion patterns, not only in the core and surface, but also within the surface; the surface displayed small chips with different inclusion patterns. In addition, distinct colour variation between the core and edges of the specimen was evident. These features suggested that the specimen is a composite where a transparent piece of synthetic ruby is covered with small chips of natural ruby.

SYNTHETIC SAPPHIRE, PRESENTED AS NATURAL ROUGH

Synthetic counterpart is a common imitation for natural sapphire rough; these are presented in two forms — one as broken, tumbled rough (**7a**), and second, as fashioned, well-formed hexagonal-pyramidal crystals with surface markings (**7b**). Although, their identification is not challenging in a gem lab, they might pose problems while buying at the mines. The specimen illustrated in **8a** was found mixed in a parcel of sapphires, purchased in Madagascar.

GLASS AS SAPPHIRE ROUGH

Two blue crystals weighing 63.93 and 44.66 ct, as illustrated in **8a** were submitted together. Both crystals displayed bi-pyramidal habits and associated white mineral, typically seen in corundum. Interestingly, there was an obvious difference in colour and transparency of both the crystals; the crystal on the right had much better colour and transparency. Closer inspection of the bright blue crystal revealed hemispherical cavities on its surface, coloured swirls and numerous gas bubbles (**8b**) — the features associated with glass. The grey-blue crystal (**8a**, left) was proved to be natural sapphire, while crystal habit and associated white mineral (kaolinite) suggested Kashmir as its origin.

CUBIC ZIRCONIA AND TOPAZ AS DIAMOND OCTAHEDRON

Cubic zirconia as diamond imitation, both rough as well as cut, have been in existence for a long time, however, in recent years colourless topaz has become a frequent encounter in diamond imitation, especially in rough form. Image **9** illustrates one such example, where the left specimen is a cubic zirconia while the right one is topaz. These stones are fashioned as typical crystal forms associated with diamond, here, octahedron; often striations, grooves or triangular markings are created on these fashioned octahedrons, giving them a natural appearing crystal. In the recent past, this author has encountered some large packets of such created 'topaz

8a: These two crystals, weighing 63.93 (left) and 44.66 (right) ct, displaying bipyramidal habits and associated white mineral, were submitted as sapphire. The crystal on left was identified as sapphire, but that on right as glass.

8b: The 44.66ct crystal illustrated in figure 8a displayed coloured swirls and gas bubbles, typically associated with glass.

octahedrons', being presented as diamond. Separation of cubic zirconia from diamond was easily done on the basis of higher specific gravity, while topaz by its anisotropic optic character. Although identification of these imitations is straightforward, when buying at mines or open markets one has to be careful.

9: These colourless octahedrons, representing diamond, are fashioned cubic zirconia (left) and topaz (right). Also note artificially drawn triangular growth markings on octahedral faces, along with iron-stained films in topaz crystal.

10a: These quartz crystals in their typical natural crystal forms are painted with green colour and coated with black mica were presented as emerald rough. Also note the horizontal direction of grooves or striations on prism face.

10b: This quartzite specimen, presented as emerald rough was first dyed, then fashioned as hexagonal crystal and randomly coated with black mica.

TREATED QUARTZ AS EMERALD ROUGH

In addition to the glass discussed above, emerald rough is often imitated by coated (**10a**) or dyed quartz (**10b**). There have been cases where transparent quartz is painted with green colour and presented as emerald, however, as illustrated in *10a*, such materials can be separated by crystal form (prism and rhombohedral faces) and horizontal direction of grooves or striations on prism faces. Another material is the quartzite variety, which is first dyed green, then fashioned as hexagonal crystal shape to imitate emerald; such fashioned crystals are often coated with black mica too. Even body colour, translucency and absorption spectrum (band at 650 nm) can separate such dyed materials from natural emerald.

SYNTHETIC QUARTZ AS AQUAMARINE CRYSTAL

This is one of the most unusual materials this author has seen for making a fake crystal — synthetic blue quartz fashioned as an hexagonal crystal of aquamarine (**11a**). The crystal was fashioned into six-sided prisms, with pyramids and basal pinacoids — a crystal form commonly seen in aquamarine. The crystal also contained a conical-tube with brown epigenetic material (such as iron oxide filling) visible to the unaided eyes. On observing the crystal from different sides, it displayed two parallel planes (seed plate) with colourless area and an attached metal clamp

11a: This blue specimen presented as aquamarine was a synthetic quartz fashioned into a hexagonal crystal, terminated by pyramidal and pinacoidal faces. Also note the conical tube containing brown epigenetic substance.

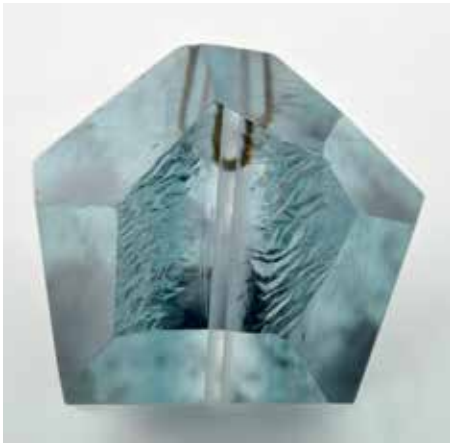
(**11b**). Such features are often seen in synthetic quartz and other gems grown by hydrothermal process. When viewed from the top i.e. down the 'c' axis, the interfacial angles between the prism faces ruled out the possibility of natural crystal form associated with crystals belonging to hexagonal crystal system, such as beryl.

As per the precision at which the nature operates, opposite sides of prism faces are parallel to each other, while in this case no opposite sides were parallel (**11b**). Identification of this specimen as synthetic quartz was established on the basis of 'bull's eye' optic figure, seed plate and infra-red spectra. Such cases remind us of the importance of studying crystallography, not only for the identification of gem rough, but also in the creation of fake rough, which the maker of this fake missed out on.

CONCLUSIONS

Fake rough is an inevitable part of the gem trade, and the scams associated with this are increasing day-by-day. Identification of rough, especially in the field is quite challenging, however, one needs to keep in mind the existence of fake material in local markets or even mines. Careful inspection of the presented rough before making a buying decision is always advisable, keeping in mind the crystallographic features. ■

All images courtesy of the author.



11b: The top view of the synthetic quartz specimen illustrated in figure 11a, revealed two parallel planes (seed plate) with colourless area and an attached metal clamp. In addition, the interfacial angles between the prism faces were evidently uneven, ruling out the possibility of natural crystal form. Also note sharp angular growth features on pinacoidal face.

"In the pile of raw ivory shown, only one species would be covered by the new law"

Maggie Campbell Pedersen FGA ABIPP offers an update on the ivory trade bans and explains that while steps are being made in the right direction, there are still some areas that need addressing.

© Maggie Campbell Pedersen.

The government consultation about whether or not to ban the trade in ivory finished in December, and the recently published results were interesting. While over 80% voted for a total ban, only a small number of those votes were independent. For example, almost 40,000 (of a total of 77,000 responses) were identical and came from the 'Stop Ivory Campaign'.

The bans are not yet law and must first be passed by Parliament, but it seems almost definite that by the end of the year we will have trade bans with the following exemptions: a *de minimis* clause, which permits items made before 1947 and containing up to 10% ivory (such as furniture inlaid with ivory); musical instruments made before 1975 and containing no more than 20% ivory; ivory miniatures; sales to and between museums; and items over 100 years old which are of significant historic, artistic or cultural value. This last category will probably be the most problematic to police, and expert advice is expected to be necessary before permits for sale are granted.

The ban, with these exemptions, should ensure there is no value – and thus no trade – in modern-day ivory in the UK. But it seems that there is a gaping hole in the proposed new law as it covers only elephant ivory. In the pile of raw ivory illustrated, only one tusk would be covered by the new law.

According to APHA (the Animal and Plant Health Agency, the government department which oversees the trade in wildlife and its products), other ivory-bearing animals such as hippos and walruses, which are now listed as 'vulnerable' on the IUCN 'Red List' (the International Union for the Conservation of Nature), will only be covered by the existing laws, that is to say, no trade is permitted in raw ivory, or in items worked later than 1947. The situation will be monitored to see whether poachers switch to these other animals.

This part of the law is not widely understood, so it will be interesting to see how the market develops. At present it appears that ivory prices vary greatly and some are high as people take advantage of still being able to buy the material. Soon, though, the expensive items bought at auction today may be worthless. ■

NEW PEARL COURSE

INTERESTED IN ORGANICS?

SSEF has teamed up with CPAA (Cultured Pearl Association of America) to help create a brand new introductory online course 'PearlsAsOne', designed to be the most up-to-date, comprehensive, inclusive pearl course available. PearlsAsOne is accessible to everyone and is a fantastic way to add pearls to your repertoire. As Aziz Basalely, CPAA president, notes: "it's an exhilarating time to be in the pearl business. A new generation of admirers and collectors is being cultivated every day."

PearlsAsOne not only teaches the science of creating pearls, but also teaches the science of selling them — filling a void that exists for many retailers. Those who complete the exam at the end of the course will be awarded with a 'CPAA Certified Pearl Specialist' certificate.

While this course normally costs $599, SSEF and CPAA have generously granted Gem-A members access to PearlsAsOne for free. You can sign up for the online course at: www.pearlsasone.org and enter the discount code 'Gem-A' at the payment menu.

Superficial Sapphires

In the second of a four-part series for *Gems&Jewellery*, Bangkok-based gem testing lab, Lotus Gemology, shares insightful pairs of photographs that, when placed side-by-side, reveal the full story of an inclusion or treatment. In this issue, we explore heat-treated sapphires...

One of the most useful and accessible tools we rely on in our laboratory is the UV lamp. This instrument can help gemmologists determine whether a stone has been treated and often helps us spot synthetics.

Many sapphires that have been heat treated display a zoned 'chalky' whitish blue or green reaction when illuminated with short-wave fluorescence. Normally this chalkiness corresponds to the colourless portions of the stone. Image **1** shows a typical example of this chalky fluorescence in a heat treated sapphire. Notice the strong, whitish blue appearance that penetrates the stone's surface.

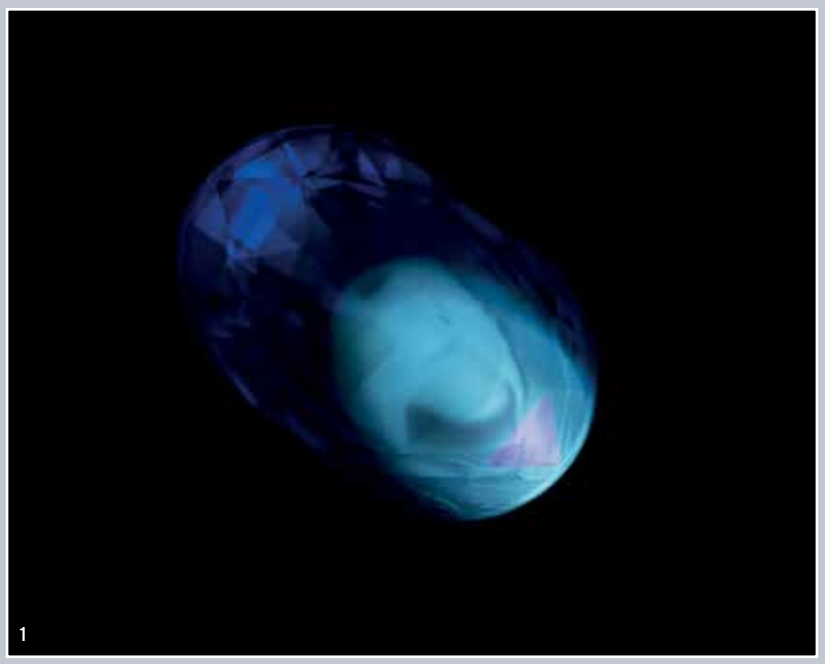
IN OUR TESTING WE HAVE NOTICED MOST OF THE STONES SHOWING THIS SUPERFICIAL FLUORESCENCE COME FROM MADAGASCAR.

However, there is one type of short wave fluorescence, which we call 'superficial' chalky fluorescence that can be misleading. This superficial fluorescence is often present in stones that are actually untreated. In our testing we have noticed most of the stones showing this superficial fluorescence come from Madagascar.

In image **2** we can see an example of this superficial type in an untreated Madagascar sapphire. Note how the fluorescent reaction is limited to a small patch that seems to be just on the surface of the stone. The superficial patch has much sharper, more defined edges compared to the fluorescent area in image **1**.

Although it may seem like a simple test, checking the fluorescence is an important procedure that should not be overlooked. ■

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

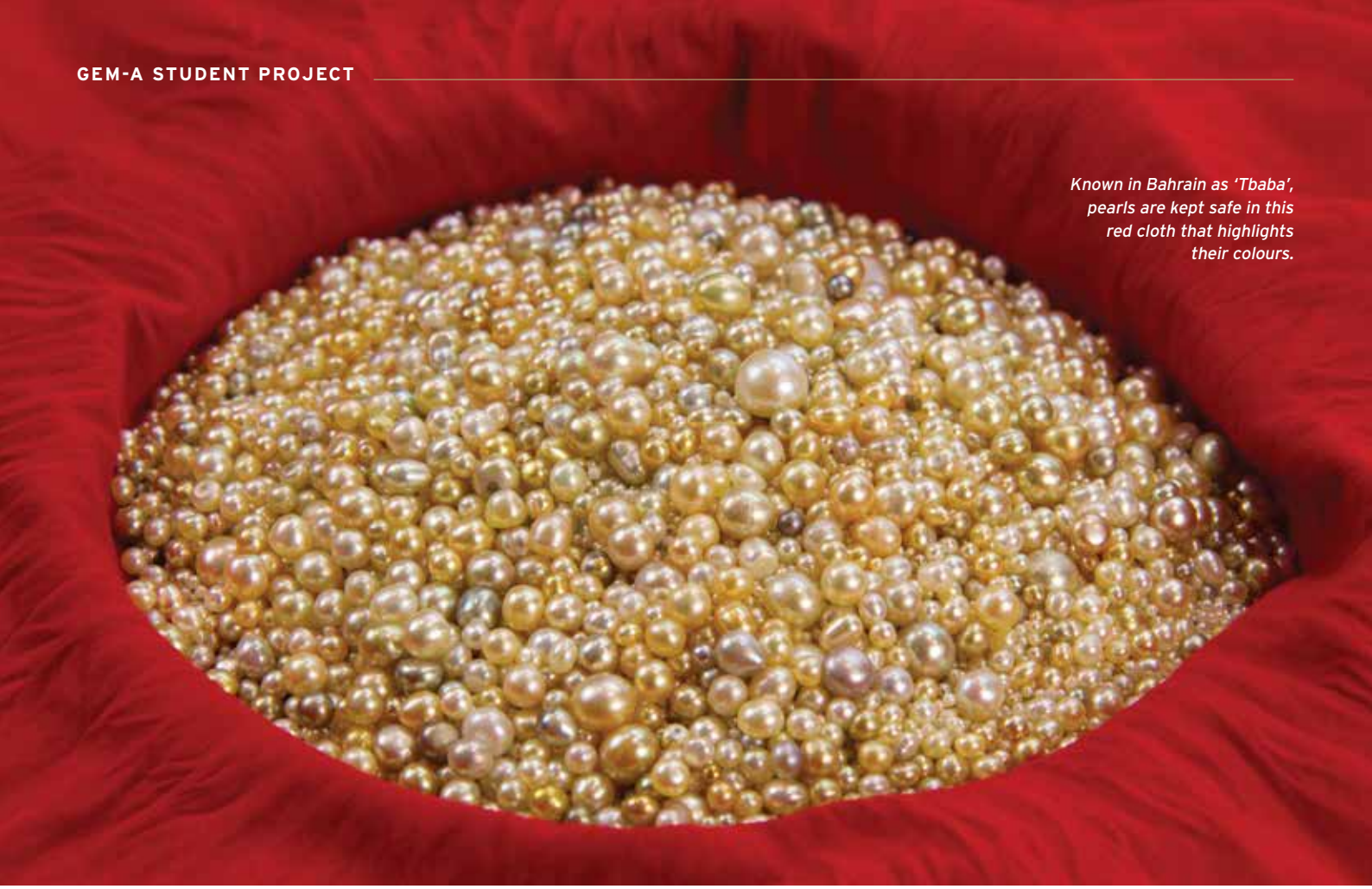


1

2

A NOTE FROM LOTUS GEMOLOGY

Both photos were shot with a MAGILABS custom designed Deep-UV Fluorescence System.



Known in Bahrain as 'Tbaba', pearls are kept safe in this red cloth that highlights their colours.

Gulf Pearls: Then and Now

Gemmology Diploma graduate, Janet Hann FGA, invites us into the fascinating world of Gulf pearls, tracing their history, gemmological properties and future prospects in her excellent student project.

This diploma project seeks to pose a series of questions related to those pearls often termed as 'Gulf Pearls': namely what a gulf pearl is; the main identifying characteristics and testing methods, and why are they held in such high regard. In search of answers, I travelled to some of the old centres of the pearling trade in the Gulf states.

HISTORICAL CONTEXT

Long before the famous French jeweller Jacques Cartier journeyed to Muharraq (present day Bahrain) to buy natural Gulf pearls, pearl trading had formed the economic lifeblood for those communities bordering the Arabian Gulf; stretching from Oman, to UAE, Qatar, Bahrain, and Kuwait. Recent archaeological excavations suggest that pearls have been traded in this region for centuries with one of the earliest found in Kuwait dating from around 5,300 BC.

Wandering around present-day Manama, Doha and Dubai, it is evident that the traditional pearling districts have long since disappeared, replaced by modern high rise upscale residential areas, office developments and shopping malls with names that reference this 'golden era'. However, concerted efforts are now being made to preserve this heritage.

In Bahrain, the former residence of the influential pearl trader Bin Matar now forms part of the UNESCO 'Pearl discovery trail'. In Dubai, work is also progressing to restore former buildings alongside the former Creekside 'pearling district', with plans to build a new museum dedicated to pearling.

Divers being pulled out of sea.

GROWTH CONDITIONS

Those pearls referred to as natural Gulf Pearls primarily grow in a species of natural saltwater bi-valve pearl producing mollusc (oyster) called 'Pinctada Radiata'; preferring the type of coastal conditions historically prevalent in the Gulf areas: warm temperatures all year-round, shallow waters, tidal flows and the availability of plankton. The Arabian Gulf was the most important source of natural pearl oyster beds, with estimates of up to 80 per cent coming from this region.[1]

The harvesting and trading of gulf pearls was governed by a strict hierarchical system and outsiders were forbidden without the permission of the local rulers. The main pearling season lasted from around May to September (with local variations) where divers might complete up to 50 free-dives a day to depths of around 27.5m. Pearling was an exhausting and hazardous existence with crews in larger boats staying out in open water for an entire season. The 'Nawkhuda' (boat skipper) would sell the catch to local merchants and distribute the profits amongst the crew depending on rank. Most of the diving community, according to sources, was permanently in debt.

These pearls were mainly shipped to Bombay where they were sorted, drilled and re-distributed, destined for the treasuries of the wealthy and powerful of the day: Maharajas, plus Persian, Chinese and European royalty. From the 20th century the biggest consumers were the US and Europe, with society jewellers based in New York and Paris such as Tiffany and Cartier incorporating them into their designs for wealthy clientele.

CHARACTERISTICS

The rayed oyster shell of the Radiata is relatively small and varies in size from 5-6.5cm, although 10-15 cm have been recorded on rare occasions. It is mostly known for producing seed pearls and some medium sized pearls. A seed pearl is a term describing a pearl less than 2mm in diameter.

Gulf pearls are 'nacreous', formed by a natural defence mechanism against irritants when the oysters filter sea water through their shells. In his book Pearls, Dr Hubert Bari proposes that pearls form around the tapeworm infested excrement of fish; the worms producing minute larvae.

A Basra pearl necklace and earrings set in silver from eastern India dated late 19th century. Image courtesy of the Gyan Museum.

If a larva becomes trapped, it tries to break through the mantle disturbing the cells producing the shell, which embalm the intruder by rotating in all directions.

The lustre of a pearl – the intensity and quality of light return – is dependent on this nacre production, greatly influenced by water temperature, depth, and salinity. The nacre is partly made up of aragonite which forms platelets on the surface of the pearl. Light passing through is diffracted and then reflected out again, producing the characteristic lustre and iridescent effect of pearls termed 'orient'. Poor nacre, whether thick or thin, gives a chalky appearance. Bahraini pearls are widely believed to be the best in the world, and their trademark lustre is thought to be partly due to the surrounding sea's freshwater artesian springs that give the island kingdom its name: Bahrain meaning 'two seas' in Arabic.

Gulf pearls range in colour from white to dark cream, more yellow than those from the same species found close by in the Red Sea and Strait of Mannar (between the northern tip of Sri Lanka and India) whose characteristic colours are very light yellow, cream and very light pink. The Pinctada Margaritifera species can also grow in Gulf waters albeit in much smaller quantities. They produce larger pearls sometimes black in colour.

While researching the sale of pearls on the internet, I also noted that many dealers especially via the internet refer to natural saltwater pearls as either, 'Gulf' 'Basra' or 'Bombay' pearls. Basra and Bombay were both ports in present day Iraq and India, respectively, where many gulf pearls were traded historically.

IDENTIFYING AND GRADING

Identifying and grading natural pearls was based on local knowledge and expertise passed down through the generations. Pearls were graded through a series of up to 25 brass sieves with holes of various sizes. A set of hand-held scales with agate weights were used to determine the weight of pearls over 2 grams. A magnifying glass was used to check the surface quality and lustre of each pearl. Based on the colour, lustre, size, shape and any surface defects a price was set for the pearls by consulting a complex set of tables in a 'pearl book'

Crewmen setting sail.

published both in Arabic and Urdu.

An extensive and rich terminology was used to describe and evaluate natural pearl shapes, colours and qualities; 'Dana', the most perfectly sized valuable and beautiful pearl and 'Hessa', a big pure white pearl, among a few examples. Undrilled pearls command a significant premium as only undrilled pearls can be termed 'Dana'. These are sought keenly by connoisseurs today.

As an organic and natural product there are significant differences in the quality of natural gulf pearls with 'genetics' playing a major role. In one test; pearls were picked at random from a bag of pearls fished over 50 years ago and 20% were found to have decayed; some with decomposed centres others with lines of weakness and surface cracking.

TESTING

Much has been written about the role of cultivated pearls and the collapse of the natural gulf pearling industry in the 20th century. Cultivated pearls can deceive even the experts and unlike gemstones and the study of inclusions, the human eye cannot see inside a pearl with a 10x lens or microscope.

Today, natural gulf pearls are still graded by traditional methods with sellers deciding the grade and price with one main exception: a lab certificate to determine whether it is natural or not. The Kingdom of Bahrain Ministry of Industry and Commerce set up its pearl testing department in 1987. Bahrain still bans the import or trading of cultured pearls and I arranged a lab visit to see

A nath (nose ring) with emerald, coral, turquoise and Basra pearls from c.18th century, Rajasthan. Image courtesy of the Gyan Museum.

first-hand the methods currently used.

Pearls from all over the Gulf region, India and beyond are sent here to be authenticated. On a yearly basis, outside of seed pearls (those less than 2mm in diameter) around 90% of all pearls tested here are natural. Natural gulf pearls command high prices and staying one-step ahead of fraudsters is an increasingly difficult task. Cultured saltwater pearls from Pinctada Maxima and Margaritifera species have been 'disguised' to resemble natural pearls from Pinctada Radiata and one recent trade alert found freshwater cultured pearls with bead centres of natural saltwater pearls.

TESTING METHODS

X -Ray Radiography: Natural and cultured pearls are usually differentiated using X-ray shadow graphs. All pearls whether loose, set in jewellery or strung on a necklace are still X-rayed here using traditional black and white film. A negative is produced and kept on record. This test with a small one shot/ one-dimensional contrast is used to reveal the internal structure and density of a pearl confirming whether a pearl is natural or cultured, a non-nucleated or nucleated cultured pearl or imitation in origin. Currently the lab does not include origin or species on certificates.

Real time Focal Spot X-ray machine: This is a real time digital 3-dimensional X-ray scanning machine with a 360-degree rotational capability that can be used to investigate those pearls that have the characteristics of natural pearls, such as shape and lustre, but look somewhat suspect.

CT 'ProCon' X-ray machine: A single loose pearl is rotated on a spindle and this sophisticated CT machine can take images of up to 1000 slices of each individual pearl for further analysis.

X-Ray Luminescence: The reaction of pearls under tests can be variable but in general X-rays cause freshwater nacre or pearls to luminesce because they contain traces of manganese. Natural gulf pearls are generally free of manganese, so luminescence does not occur. This method is limited when nacre is rich in colouring pigment as this generally suppresses the luminescence. This can occur with both naturally coloured and dyed pearls.

NEW TESTING METHODS

SSEF announced in 2017 that they were able to include age dating of natural pearls by Ca14 known as carbon dating. It is also very likely that species and origin identification of pearls by 'DNA Fingerprinting' will also be available to clients, suggesting that identifying 'Gulf' grown pearls will be available in the future.

THE PRESENT

While many of the old pearl beds have been destroyed due to land reclamation, pollution and off-shore projects, oyster beds in the region are still productive. In Kuwait, it is still permitted to dive for pearls. In Bahrain, oyster beds still exist with some protected by UNESCO, and oyster beds can also be found within the 'Exclusive Economic Zone' of Qatar. Divers in general need a government permit and tourists

White pearls with very high lustre.

A process known as 'Falg Almahar' with divers and crewmen opening oysters.

can also still join dives in Abu Dhabi. Divers in Bahrain still present pearls at the lab, but it is obvious luck is involved; the chances of finding a commercially viable pearl (at least 2mm in diameter) is estimated to be around 5 per cent.

Whilst the 'Peregrina', a natural fresh-water pearl still holds the record for a pearl sold at auction at 11.8m USD, natural exceptional saltwater pearls command high prices too. In 2013, a natural saltwater pearl and diamond necklace sold at Christie's for 8.4m USD and a seven-strand natural pearl and diamond necklace sold for 9.08m USD in the same year.

NOTABLE PRIVATE COLLECTIONS

The Emirates NBD Pearl Museum in Dubai showcases one of the largest displays of natural gulf pearls in the world. Once the private collection of Ali Bin Abdullah Al Owais, a former pearl trader and his son Sultan Bin Al Owais (1925-2000) the first chairman of the National Bank of Dubai. In 2000, he gifted the pearls to the museum which can be visited by appointment.

The Al Mahmood family (Bahrain) have been an integral part of the pearling industry for seven generations and established their first jewellery showroom in 1982. They still purchase pearls directly from divers in the region, incorporating them into high-value jewels in collaboration with couture jewellery houses, such as Bulgari.

Mr Hussein Alfardan (Qatar) is considered a pre-eminent world authority on Gulf pearls. He is said to have gathered, sorted and evaluated the largest collection of loose Gulf natural pearls in the world. He collaborated with Fabergé in 2015 to design the first 'Imperial Class' egg since 1917, inspired by the formation of a pearl within an oyster. All the pearls used were from his private collection.

The Al Thani dynasty has been Emirs (rulers) of Qatar since 1850. Their extensive and exceptional collection of decorative arts such as the 'Pearl Carpet of Baroda', sold by Sotheby's in 2009 for 5.5 million USD, is now housed in the Doha Museum of Islamic Arts. The carpet is embroidered with around one and a half million 'Basra' pearls of 1-3mm in size, harvested in the southern Gulf region.

Given the success rate of one pearl for every 500 oysters fished that equates to around 750 million oysters.

In the open market, the primary source of natural Gulf pearls today is from existing stocks such as the trading centres in India and former empires where vast treasuries of pearls were held historically. Others come from antique jewellery collections which are broken down, pearls removed one-by one, recycled and sold.

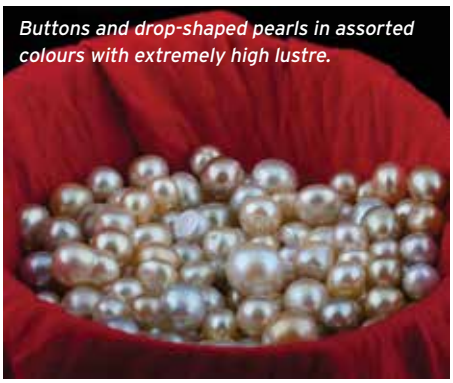
THE FUTURE AND FINAL THOUGHTS.

The ownership of natural gulf pearls has a long history of exclusivity, adorning only the supremely wealthy. Given recent ecological evidence, it is likely that oyster beds still found in the region will continue to decline as the loss of natural habitat, changes in sea temperatures and pollution take their toll. The finest natural pearls from existing collections will continue to be traded in a rarefied marketplace, with the finest necklaces seen as investment pieces to rival the best natural coloured diamonds and works of art.

ACKNOWLEDGMENTS

Thanks to Abeer Al-Alwai, executive director of DANAT (Bahrain Institute for Pearls & Gemstones), Lubna Ebrahim Mattar and Mattar Jewelers in Bahrain, and the Gyan Museum in Jaipur, for supplying the images that illustrate this article. ■

All images courtesy of Mattar Jewelers — The House of Natural Pearls, unless otherwise stated.



Buttons and drop-shaped pearls in assorted colours with extremely high lustre.

Footnote

1 Historical estimates vary considerably with some sources estimating 50% and others 70-80%, with the majority in the latter category.

An unabridged version of this project is available upon request.

Lights, Camera, Action!

Amelia Grant (Gemporia) Natalie Graham (JTV) and Lizi Glazebrook (QVC) chat to Gem-A about what it takes to sell gemstone jewellery on TV and Youtube, and how authenticity and education is key to building a strong and trusting relationship with their audiences.

AMELIA GRANT, presenter, Gemporia

Amelia Grant highlights a necklace to her audience. Image Credit: Gemporia.

When Amelia Grant heard that British television and online jewellery retailer, Gemporia was looking for on-air presenters, she jumped at the chance to follow her TV ambitions. Here she explains what makes selling gemstones on television such an exciting challenge.

What are the challenges of discussing gemstones on television to an audience who cannot touch or feel a piece?

One of the biggest challenges is describing the beautiful characteristics of gemstones that don't necessarily come across on screen. For example, the unique colour-play of opal or colour change properties of csarite are easier to see with the naked eye. I try to find as many ways to describe to our customers what they may not be able to see in all its glory through the screen.

How do you build the right level of trust with your audience so they feel confident to spend on a particular gem?

Time and authenticity are essential for building trust with our customers. You always have to tell the truth and represent the jewellery and gemstones as accurately as possible. With new customers, Gemporia's offer of a 30-day money back guarantee for all customers gives them the opportunity to order with no risk as they can just return if they don't like it.

What is your favourite thing about being a presenter and what are the hidden challenges or tricks of the trade that we might not know?

My favourite thing? The bond you build with the customers. I love being on air and getting messages to the studio from all our customers that are tuning in. As for hidden challenges, the air con! We have to keep the studio cool because of all the equipment but it can get pretty chilly. I have been known to sneak my feet into my slippers from time to time!

The internet is full of misinformation and people can be distrustful – how would you respond to those who question the quality of what you're selling and ask why such fantastic gems can be so reasonably priced?

Our reasonable pricing is down to our business model. Every step in the typical jewellery retail model increases the final price you pay. By bringing many of these steps in-house and carefully controlling the design and production of our jewellery Gemporia incurs much lower costs than our high street competitors. For this reason, we can offer our jewellery at significantly lower prices.

We control much of the process of making our jewellery, often right from the gemstones being mined through to the finished piece that you see on air. We source directly from the mines whenever possible. Rough gems are cut and polished, and we always cut for beauty, rather than higher carat weight.

Having an authentic and honest conversation with the audience is essential. Image Credit: Gemporia.

Natalie Graham prepares to film a YouTube video. Image Credit: JTV.

NATALIE GRAHAM, gemmologist and YouTube host for JTV

Having started her career in jewellery retail, Natalie Graham pursued her passion for gemstones at GIA before securing an internship with an international gem buyer in Brazil. This experience led her to a position at JTV, where she is now a member of the Gemstone Advancement and Education team.

Showcasing obsidian with the help of a dedicated cameraman. Image Credit: JTV.

What challenges do you face when communicating about gemstones on YouTube — how do you build that sense of trust and authenticity with your audience?

One of the surprising challenges I face when shooting YouTube videos is overcoming how impersonal the interaction with the viewer can feel because of the camera separating us. I am ultra-conscious of whether I am appearing inclusive and authentic to our audience because, ultimately, I want to create a lasting relationship with them. It is also challenging to show the viewers what I am excited about in a stone or what grabs my attention because the cameras cannot always pick up every little detail. As a result, building trust is crucial.

Demonstrating that you are trustworthy goes beyond simply having gemmology credentials; it is equally important to be able to admit when you don't know something. The study of gemmology is so vast that it is impossible to know everything, and I think it is helpful for my viewers to see that I am learning things along with them.

There is so much inaccurate information out there on the internet, do you think YouTube is a good way of dispelling some of these myths and offering customers value added?

I think YouTube is a fantastic way of dispelling myths and offering value. It is incredibly convenient to view and subscribe to YouTube content making it a fantastic platform for accessing the masses.

Our videos are fun and casual making them very accessible to viewers of all types. Because of the connection we have with our audience, we have established credibility which allows us to address any existing misinformation and replace it with engaging, accurate information. Being supported by a community of experts, who often appear alongside me as guest hosts [including Gem-A CEO Alan Hart FGA DGA], adds to our credibility. There is an amazing team working diligently behind the scenes brainstorming, researching, and reviewing all the information that goes into each video.

What are your top tips for presenting and public speaking in this context — what would be your advice to anyone wanting to follow in your footsteps?

The best thing you can do to prepare for public speaking is to practice! Also, never be afraid to sound funny or strange. I realised immediately that for me to do my best work I had to relax and be myself. As for advice to fellow gemmologists who wish to follow in my footsteps, I will share with you what a dear friend in the business once told me "when the cookie tray comes around, take the cookie. You never know when it will come back."

Take whatever opportunities come your way. Before we started our work, we had no idea the channel would be so successful, so I am sure glad I took that cookie!

Can you share with us some of the highlights of your career to date and any memorable gem moments

The YouTube channel has certainly been a highlight. I have thoroughly enjoyed the opportunity to share my passion for jewellery and gemstones with the YouTube community. I love hearing from viewers who have a new-found interest in our industry. Another highlight was an internship I had in Brazil after I graduated GIA.

It was an adventure during which I experienced the business from the ground up. The amazing food, music and 2016 World Cup were added perks! I can't wait until I have another opportunity to return. As for memorable gem moments, I will never forget my first day walking through the AGTA gem show as a GIA student. I was floored at the amount of beautiful, quality stones.

Natalie Graham sorts through sea glass in the darkened room she uses for filming YouTube videos. Image Credit: JTV.

LIZI GLAZEBROOK, gem-set jewellery expert and gold buyer, QVC UK

QVC UK buyer Lizi Glazebrook. Image Credit: QVC UK.

> At QVC we use our expert guests to educate and engage the customers with the story, history and technical details...

As one of the world's largest multimedia retailers, QVC broadcasts to 230 million homes, 24-hours a day, and 365-days per year. QVC was founded in 1986, but found its way to the UK in 1993. We spoke to QVC UK buyer, Lizi Glazebrook, to find out what goes on behind-the-scenes of a broadcasting powerhouse.

As a buyer, what do you perceive as the biggest challenge when it comes to selling via the television?

The audience cannot touch or feel the piece. At QVC we use our expert guests to educate and engage the customers with the story, history and technical details behind the items, use the studio cameras and FMV technology to show 360 degree close up views of the detailing, models wearing the pieces to show scale and our presenters to bring it all to life.

Today's online retailers have the same challenge in that respect and, with QVC seeing big growth in our online business, we feature clips from the live show on the product page to allow customers to re-watch and make an informed purchase.

Customers are vocal and honest with us via our customer reviews, calls to the call centre and social media with what they think and want from their jewellery. We do our best to work on that feedback and satisfy their requests. For jewellery specifically, building the customers' product knowledge by providing as much information/education as possible via our on-air discussions also empowers them and gives the customer more confidence to buy.

How do you respond to those who question the quality of products or show distrust in the QVC brand?

I'd suggest those who question the quality try it for themselves first. QVC works hard to deliver quality at great prices and those in doubt have the ability to buy the item and see it for themselves while knowing they can return it if they are not satisfied in any way.

We work directly with the countries where the stones are mined and the jewellery produced, and have built strong relationships there over the years to be able to deliver the best prices for customers. For additional assurance, many of our higher value items come with independent certification. ■

A jewellery presentation in action. Image Credit: QVC UK.

The lush green landscape of Colombia is mirrored in its famed emeralds. Images from Pexels.

BEYOND THE GREEN

Gem-A tutor, Beth West FGA DGA, explores the Muisca people and the emeralds of Colombia.

There is a brooch displayed at the heart of the Geology, Gems and Minerals Gallery in the Smithsonian Institution in Washington, USA. It is centred on a large luminous green emerald surrounded by diamonds as sharp as stars. It is undoubtedly beautiful; designed by Tiffany & Co. in the 1950s, it evokes an era of glamour and grace. But as exceptional a piece of design as it may be, the brooch is little more than a throne for the emerald that it carries. The Hooker Emerald, named after the Institution's principal benefactor, Janet Annenberg Hooker, weighs 75.47 carats and was originally extracted from present-day Colombia in the 16th century, when talk of the majesty of these gems had only just begun to travel.

The Spanish Conquistadors arrived in the 'New World' in the last decade of the 15th century. When Hernan Cortez was presented with emeralds by the Aztec Emperor Montezuma II in 1519, the allure of the green gem incited the greed of the invaders and a bid to uncover their source was advanced, often leading to violence and the ultimate mistreatment of the indigenous tribes.

While emeralds became symbols of status and wealth at the end of the trade route set up by the Spanish to India and Europe, what did these stones mean to the original inhabitants of the luscious and majestic Andean terrain?

The first of the tribes' emerald deposits was located by Conquistador, Gonzalo Jimenez de Queseda in 1537 in the village of Somondoco – home to the Muisca (or Chibcha) people. This deposit would come to be known as 'Chivor', meaning 'our farm fields, our mother' or 'green and rich land' in the native tongue of the Chibcha, a reference to the emeralds un-earthed there.

The Muisca people were one of the four principal civilisations of the Americas. The other three, the Incas, the Mayans and the Aztecs are perhaps more prevalent in Western thought due to the grandeur and ceremony of the architecture that remains as evidence of their complex culture. But the Muiscas were no less advanced; they were a self-sufficient people existing in comparative isolation in the highlands of the Cordillera Oriental of the Northern Andes.

It is in this Eastern chain of peaks that pockets of the finest emeralds had formed.

The abundance of the precious mineral within the Muisca's territory, and the ability of the people to mine it efficiently, made it an important economic resource. Markets were held regularly in conjunction with calendared festivals during which the Muisca would trade the emeralds with gold from the Guane people from north of the Chicamocha River, yopo (a hallucigenic snuff), exotic feathers and jaguar skins from the lowlands, marine snail shells, avocados and the still celebrated 'ice-cream bean' from their coastal cousins, the Tairona people.

An emerald in matrix. Photo Credit: Henry Mesa @ Gem-A.

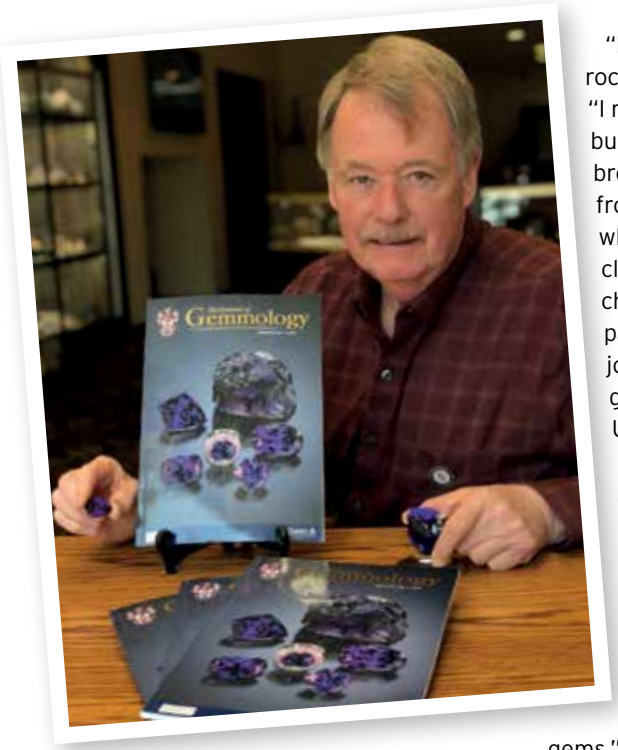
There is no evidence to suggest that emeralds were ranked higher in value than the other traded goods, but it is apparent that the stone held substantial symbolic weight.

In 1637, the writer Juan Rodriguez Freyle documented an initiation ceremony performed by the Muisca. On the event of a ruler's death, the successor would be covered with a fine dusting of gold and placed on a raft at the centre of Lake Guatavita. As music and dancing defined the shores, the new leader would throw gold and emerald votives into the lake as offerings to the Sun God. This became known as the myth of El Dorado and rumours of a place saturated with such potential material wealth have been, from the time of its discovery to the present day, exploited by the greed of Western adventurers. This imposition of material desire on the lands of the natives has ultimately led to wars and bloodshed over the centuries.

Therefore, is it perhaps worth considering the stance of the Muisca, who did not covet the emerald as their own but accepted it as a spectacular gift from the mountains, and one that they would happily relinquish to maintain harmony with the gods. If we were to eliminate the profitability of the gem, could we too be able to see deeper into that mesmerising green? Idealistic? Perhaps. I cannot see anyone throwing the Hooker emerald into a lake any time soon. ■

A FAMILY AFFAIR

For 40-years the Moriarty family has been dedicated to the pursuit of exceptional gemstones for its gem-cutting and jewellery business, based in Indiana in the United States. *Gems&Jewellery* caught up with co-owner and Gem-A Associate Member, Steve Moriarty, to find out more about his fascinating career in gemmology.



Steve Moriarty with Gem-A's The Journal of Gemmology, which features his carved Rwandan amethyst on the cover.

Although a gem specialist's career can often start confined to a classroom or a lab, pouring over stone samples and peering through a microscope, our industry also offers wonderful opportunities to travel around the globe.

Steve Moriarty is not only the co-owner of Moriarty's Gem Art in Crown Point, Indiana, but also an experienced gem-cutter and gem explorer. His family-run business, including the websites **moregems.com**, **tanzanitejewelrydesigns.com**, **opallust.com** and **mothersfamilyrings.com**, was founded in 1975, and today Steve, his wife Nancy, and two of their three children work together to offer a gem-orientated retail experience. Add to this Steve's 25-years as a professional gem-cutter and it is clear that he has seen, worked with and sold some incredible gemstones.

"Ever since I was young, I collected rocks and fossils," Moriarty comments. "I really got interested in the gem business while I was in college; my brother Tom started importing gems from India and would send me stones, which I took to the jewellery arts classes to sell." Despite a stint as a chemist, Moriarty opted to follow his passion for gems and in 1975 he joined his brother selling coloured gems to jewellers in the Midwest United States.

In these early years, Moriarty says that "colour was not important to most jewellers," which made businesses like his rare in the region. "My wife Nancy and I started on our own as Moriarty Gem Corporation in 1984 and I began travelling overseas to Thailand for cut gems." By 1994, with his passion for travelling, buying gems and selling them to retailers waning, Moriarty established his own retail store – now Moriarty's Gem Art – in Crown Point, Indiana.

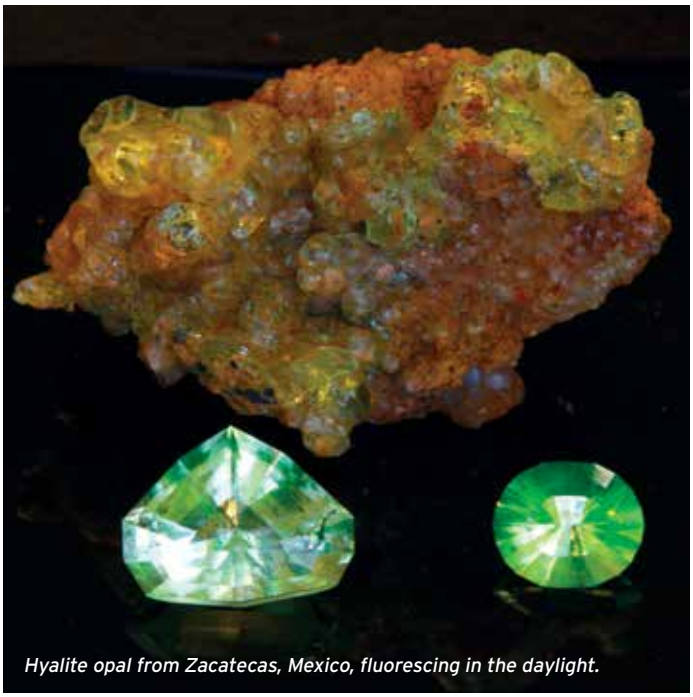
He says: "Cutting gems, creating jewellery, custom orders and four websites is almost more than we can handle at times! I love to cut gems, this is my first priority. But to sell enough of those gems you need to do something with them, and many of the gems end up [as] unique shapes, so most everything is a custom piece. The greatest difficulty my designers and I have is we want to be artists and create our vision, but most often we have to recreate the customer's vision, or what they saw on Pinterest or somewhere else online."

Despite this, the frustrated gem artist in Moriarty is usually restored by incredible finds and far-flung travels. When asked to describe his most inspiring trips, Moriarty points to the early 1980s, when a trip to Kenya revealed that the border to Tanzania had just been opened to American tourists. "The next day we were off on the five hour bus ride from Nairobi to Arusha, and my love of tanzanite began," he says.

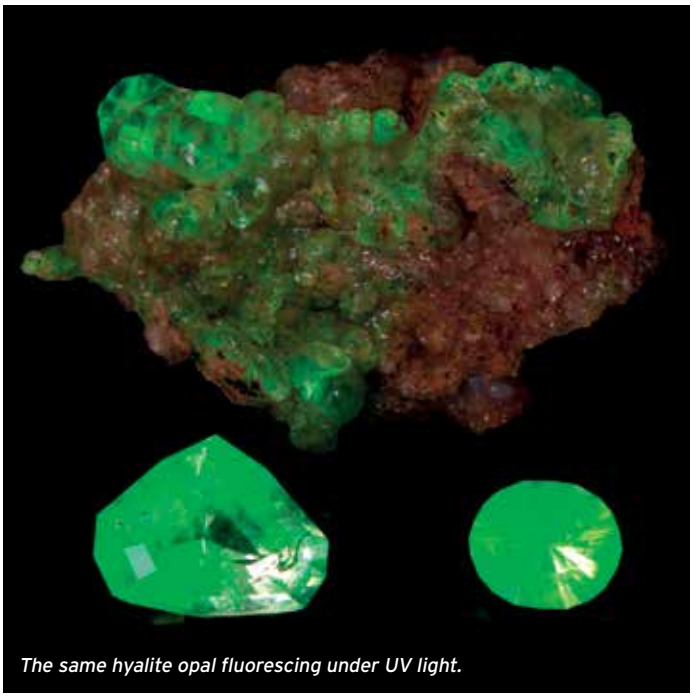
On a later trip in the early 2000s, Moriarty and his long-time travelling colleague, Jim Fiebig, discovered an "amazing cornucopia of gems" in Madagascar. He says: "There was so much amazing material that we were rejecting great gems just because they were priced a little high compared to the abundant bargains we were getting. I had many great trips to Madagascar after that, buying many of the finest quality gems I have ever owned, but never again in such quantity as the first trip."

Today, Moriarty focuses his freeform

A rough garnet and its cut and polished counterpart.



Hyalite opal from Zacatecas, Mexico, fluorescing in the daylight.



The same hyalite opal fluorescing under UV light.

The greatest difficulty my designers and I have is we want to be artists and create our vision, but most often we have to recreate the customer's vision, or what they saw on Pinterest or somewhere else online.

carving attentions on Ethiopian opal, which can "require up to two full days to get a decent polish" because of the undulating surfaces.

In addition, Rwandan amethyst, carved by Moriarty, recently appeared on the cover of Gem-A's *The Journal of Gemmology* (Vol.36 No.1). Although amethyst is not high on Moriarty's carving 'wish list', this material was particularly impressive. "I had been cutting Uruguay material for 20 years and considered it to be amongst the finest in the world, but when I saw the intensity of the secondary red and blues [in the Rwandan amethyst], I was hooked."

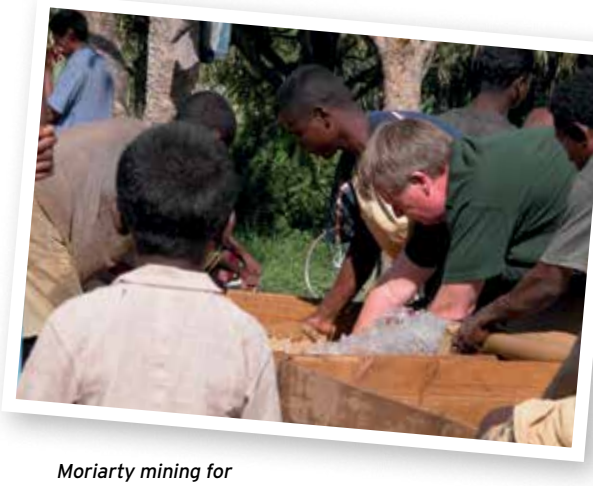
Moriarty also mentions daylight fluorescent hyalite opal from Zacatecas, Mexico — another find that truly inspired him. After discovering some specimens at the Denver Gem & Mineral Show, he returned home and ended up cutting 7.27 carats — one of the largest faceted opals of this type. "We posted our video on YouTube just before we went to Tucson and someone shared it on reddit.com. In three days, it had been viewed over a million times. Currently, total viewing is over three million."

He continues: "I spent some time looking for hyalite opal to compare pricing, but was unsuccessful finding any cut stones in Tucson 2018. One dealer who specialises in rare gems, did give me an idea of the price [as he had] sold one of five carats. This led me to immediately call my office and have them put the hyalite in the safe and take it offline. It seems this material, discovered in 2013, was mined out by 2016 and was very unique for its characteristic of daylight fluorescence. Our next call was to the dealer who sold me the rough and we met and purchased anything of quality that he had left."

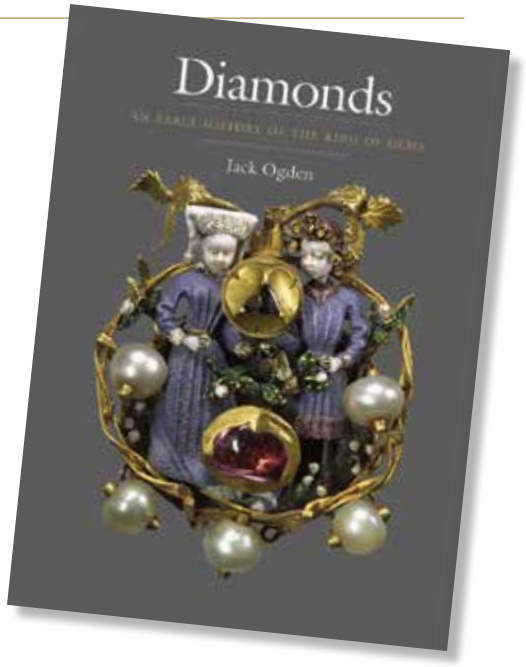
There is an excitement to this lifestyle, of chasing down gems, that is particularly appealing to those getting started in the field. However, Moriarty also enjoys cutting his 'old favourites'. He explains: "I love cutting garnets and although the prices for garnets of unusual colours have gone up dramatically, I still think they are under-valued. When I get done with a garnet, to me, it looks as good as any diamond I have ever seen."

Despite his love of travelling, Moriarty is enjoying the fact that his latest obsession – Oregon sunstone – is much closer to home. And who can blame him for wanting a little more time? After all, there are gems to cut, custom orders to fulfil and a wealth of websites to be cared for... it is all in a day's work for the Moriarty family. ■

All images courtesy of Steve Moriarty and Moriarty's Gem Arts.



Moriarty mining for sapphires on a trip to Illakaka, Madagascar.



KING OF GEMS

In this extract from the stunningly illustrated *Diamonds: An Early History of the King of Gems* by Jack Ogden FGA, we delve into the history of Medieval Europe and discover some rare surviving examples of diamond-set wonders.

SURVIVING LATER MEDIEVAL JEWELLERY SET WITH DIAMONDS

(From Chapter 4: Medieval Europe)

Despite the relatively abundant documentary mentions, there are few tangible examples of diamonds in Europe until the mid-fourteenth century. An early example is a gold ring from Clerkenwell in London, now in the British Museum, set with an octahedral diamond, and of thirteenth- or fourteenth-century date. This has the inscription (in French) probably to be read 'I am here in place of a friend, yours with this gift' and a clasped-hands motif on the back of the hoop, showing that this was a love ring and thus probably a betrothal ring. This ring is perhaps the earliest surviving diamond-set ring with love associations, and it is unfortunate that it cannot be more precisely dated. The inscription is in Lombardic script, which is typical of the thirteenth and fourteenth centuries, being superseded by Gothic 'black letter' in the second half of the fourteenth (Ward et al. 1981, 54). A similar ring, with clasped hands and a Lombardic love inscription set with a sapphire, was found in Hatfield Forest, England, in 1980 and has been dated to the thirteenth century (British Museum inv. 1980,1202.1; Ward et al. 1981, 64; Alexander and Binski 1987, 484 no. 646). There is a nail reliquary, which is a holy relic supposed to contain one of the nails used to crucify Jesus, mounted in gold incorporated into the gold reliquary cross in the Treasury of St. Vitus Cathedral in Prague. At one end is mounted a small octahedral diamond crystal, at the other a blood-red ruby (figures **4.3** and **4.4**). The cross itself was made in the 1350s by order of Charles IV, emperor of the Holy Roman Empire (1316–1378), known to many as King Wenceslas. The nail reliquary attached to it is probably not much earlier, as suggested by its enamelled 'black letter' inscription. The cross, the nail reliquary, and the gems set in it were examined in detail by Czech conservator and photographer Andrej Šumbera in 2003 (Šumbera 2008). A fresco in the Chapel of the Virgin Mary at Karlstejn Castle, Czech Republic, shows Charles being presented with what appears to be an octahedral diamond — possibly the one set in the nail reliquary. The identity of the donor of the diamond is uncertain. Possibilities include King Louis I of Hungary (reigned 1342–1382); Peter I, king of Cyprus and king of Jerusalem (reigned 1358–1369); or the Byzantine emperor John V Palaiologos (ruled 1341–1391). If the latter, the diamond may have been a diplomatic gift to help secure military aid against the Turks.

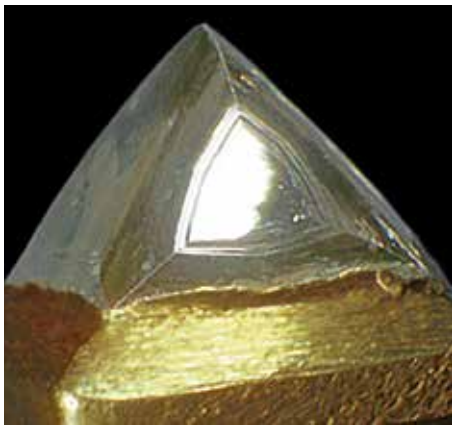
> THERE IS A NAIL RELIQUARY, WHICH IS A HOLY RELIC SUPPOSED TO CONTAIN ONE OF THE NAILS USED TO CRUCIFY JESUS...

Another important medieval diamond-set object is the so called Founder's Jewel in New College, University of Oxford. It is in the form of a crowned Lombardic initial M and was made in about 1350, probably in France. Among the rubies, emeralds, pearls, and enamel is a single, small, uncut diamond, set top centre. This ornament is also known as the Hylle Jewel because it

4.3: Holy nail reliquary in gold and enamel set with a octahedral diamond and ruby, incorporated into the gold reliquary cross in the Treasury of St. Vitus Cathedral in Prague. Photo: Andrej Šumbera.

was a gift to the college in 1455 from the Hylle family of Winchester.

In the final third of the fourteenth century, we have surviving diamonds in greater profusion. One of the most spectacular examples is the Crown of Princess Blanche, also called the Bohemian or Palatine Crown, now in the treasury of the Munich Residenz (figure **4.7**). This splendid gem-set gold crown left England as part of the dowry of Princess Blanche, daughter of England's Henry IV, who married Ludwig III in 1402. It was originally owned by Anne of Bohemia, who had married England's King Richard II in 1382 and was probably made in Paris around 1370–80. Medievalist Jenny Stratford has recently discussed the crown at some length in her book on the treasures of Richard II based on the surviving treasure roll listing compiled in 1398/9, now in the National Archives (E 101/411/9; Stratford 2013, 258–62). This extraordinary scroll is more than thirty yards long when unrolled. The crown is perhaps the only surviving piece of the 1,200-odd jewels listed in the king's inventory. The crown is set with sapphires, spinels, emeralds, and pearls, and, nestling in the centre of quatrefoil clusters of pearls, there are diamonds (figure **4.8**) or, in several cases, imitation diamonds. The quatrefoil pearl clusters may be similar to the three rings each of "four pearls and a great diamond placed in the middle of each" that Richard II purchased from a London goldsmith, John Palyn, for Anne of Bohemia in 1381/2 (Devon 1837, 221). The inventory refers to the crown as being set with thirty-three diamonds, of which eight were imitation. The genuine diamonds are very small octahedra, uncut but of reasonably regular shape. The imitations are pyramids of gold, probably integrally made with the settings, with applied black enamel (the apex of each blackened gold pyramid is of exposed gold; perhaps the enamel pulled back from the apex as a result of surface tension while firing). The same inventory also includes a mirror back and an image of the Virgin Mary with clusters of pearls around what are described as imitation diamonds (Stratford 2013, 288, 361). Also listed are collars that incorporate diamonds, thus challenging the oft-repeated statement that the earliest diamond necklace recorded was



4.4: Detail of the diamond set in the nail reliquary of figure 4.3. Photo: Andrej Šumbera.

that belonging to King Charles VII of France's favourite mistress Agnès Sorel (1421– 1450). A chalice in the inventory was later described as set with three large diamonds, and another chalice and a pax (tablet) are noted as each including a flat diamond (Stratford 2013, 79, 361, R980, and R982). The rings set with diamonds remind us of the 'diamaundes of derrest pris' set in gold rings, as mentioned in the 1370s by the English poet William Langland (Kane and Donaldson 1988, 255).

Several European diamond rings dating from around the late fourteenth to early fifteenth centuries have survived that have a high bezel set with an octahedral diamond crystal, such as that shown in figure 4.9, now in the Victoria and Albert Museum, London. Recently, two similar rings have been found in England, one at Manley, Cheshire, in 2002 (figure **4.10**) and another at Fleckney, Leicestershire, in 2008. Both rings were found by metal detectorists and subsequently passed into the market. The ring in figure 4.10 is inscribed 'sans fin loiauté'—loyalty without end. It also bears three letters E of uncertain significance; a connection with King Edward III (reigned 1327–1377) was proposed by the finder, but seems speculative. A similar style ring is in the Museum Mayer van den Bergh in Antwerp (inv. 428i) (Kockelbergh et al. 1992, 46). In 1819 a gold ring set with a small cabochon ruby and five diamond crystals was found in the ruins of the Eltham Palace that Joan Evans dated to the later fourteenth century (King and Clayton 1834, 7; Evans 1921, 63). It was inscribed "Qui me portera exploitera et a grat joye revendra," which was translated as "Who wears me shall perform exploits and with great joy shall return," and was thus presumably for a man.

4.7: The Crown of Princess Blanche or the "Bohemian Crown," Paris, ca. 1370–80. Credit: Munich Residenz, Munich. Photo: Jack Ogden.

Other European diamond-set jewelry of the fourteenth century includes a diamond-set ring purchased for 111/2 florins in Florence in 1354/5 and the diamond rings that we are told Philip the Bold distributed to Charles VI and other nobility in Dijon in 1390 (Stuard 2006, 134; Vaughan 2002, 196). The inventories of Philip the Bold, Duke of Burgundy from 1363 to 1404, include numerous diamond-set jewels (Prost 1902–4). We don't know how big the three 'large' diamonds in Richard III's treasure were, but probably far smaller than the diamond reportedly the size of a walnut that was listed as part of the dowry of Valentine Visconti, daughter of the Duke of Milan, when she married Louis, Duke of Orléans, in 1398. This diamond, then known as 'Balle de Flandres', passed to Charles the Bold and then seemingly disappeared when Charles was defeated at the Battle of Grandson in 1476. This may well have been the diamond that eventually resurfaced recut as 'the Sancy' (Balfour 2009, 244). If so, with the Sancy weighing some fifty-four carats cut, the Balle de Flandres must surely have been some seventy plus carats to start with.

Not all the diamonds reaching Europe in the later medieval period came via the northerly Silk Route. They could have been obtained by European merchants in Alexandria and other Mediterranean trading centres at the interface between the European and Islamic worlds.

4.10 Diamond-set gold ring found at Manley, Cheshire, England, in 2002, late fourteenth century. Courtesy of Christie's, London.

4.8. Detail of a pearl and diamond cluster on the crown in figure 4.7. Photo: Jack Ogden.

TIFASHI MADE MUCH THE SAME COMMENT… THE MOST BRILLIANT DIAMONDS WERE "WORN BY INDIAN DIGNITARIES… THEY KEEP IT JEALOUSLY FOR THEMSELVES…"

The more southerly land routes to the Mediterranean and the coastal sea trade from the Red Sea or Ormus to India were thriving, with Arabs playing a significant role until they were largely displaced by Europeans in the sixteenth and seventeenth centuries. In the sixteenth century Garcia de Orta mentioned Arabs in India sending diamonds to "Arabia" (Markham 1913, 343). In his *Best Thoughts on the Best of Stones*, the Arab poet and author Ahmad al-Tifashi (died 1253) says that Baghdad was a major centre for the diamond trade and repeats what he was told about diamonds by "some Persian gem dealers who often visit India." Tifashi, who was born in Algeria, also mentioned jewelers from North Africa who were acquainted with diamond (Abul Huda 1998, 119). Tifashi made much the same comment as Marco Polo, that the most brilliant diamonds were "worn by Indian dignitaries for adornment purposes; they keep it jealously for themselves," and the rest were either used for cutting corundum or "given to the merchants."

As we have seen, the commerce between Europe and the Islamic world was growing as the first millennium came to a close, with the Italians playing a major role. It is only after about 1200, however, that we begin to find clear documentary evidence for diamonds in medieval European jewellery, with a gradual increase in mentions over the following decades and surviving examples from the later 1300s. ■

Diamonds: An Early History of the King of Gems *by Jack Odgen. 2018. Published by Yale University Press.*

Events Directory

Your essential guide to gemmological events

EVENTS


© Cyril Davenport

The Crown Jewels
14 June 2018 8am
Ever wished to view the British Crown Jewels at the Tower of London without the queue and the crowds?

Join us for an exclusive Gem-A private tour by booking via Eventbrite. Tickets are £25 for members and £30 for non-members, plus a booking fee. Please visit https://gem-a-crown-jewels-exclusive.eventbrite.com Password: BLACKPRINCESRUBY

Sainte-Marie-aux-Mines
21-24 June 2018
Will you be attending their 55th international Mineral & Gem show in France this June? If you wish to write up your experiences and become a *Gems&Jewellery* contributor contact us: editor@gem-a.com
sainte-marie-mineral.com/english

Dallas Mineral Collecting Symposium
24-26 August 2018
Dallas, Texas, USA
dallassymposium.org

IJL 2018
2-4 September 2018
Olympia London
jewellerylondon.com

Hong Kong Jewellery & Gem Fair 2018
12-16 September 2018 AsiaWorld-Expo Hong Kong
14-18 September 2018 Hong Kong Convention & Exhibition Centre
exhibitions.jewellerynet.com/9jg/en-us

Denver Gem & Mineral Show
14-16 September 2018
Expo Hall of the Denver Mart, 451 E 58th Ave, Denver, 80216.
denvermineralshow.com

Gem-A Open Evening
18 July 2018, 4pm-7pm
Have you always wanted to learn about gemmology but weren't sure where to start?

Gem-A are the oldest gem and jewellery educators in the world. We are based in London's historic jewellery quarter and in July we are opening our doors for you to come along, meet the team and try some gemmology for yourself.

Drop in anytime between 4pm and 7pm, we will have activities running throughout the evening and plenty of staff on-hand to answer your questions

GEM CENTRAL

Correction: 13 June 2018, 6pm
Held at Gem-A headquarters in London, Gem Central is a practical gemmology evening for Gem-A members and students, giving attendees the opportunity to investigate and explore a variety of gem materials. The next Gem Central will be hosted by Dr. Leon Barron, senior lecturer in Forensic Science at King's College London. Dr. Barron will explore innovative ivory fingerprinting technology and its implications for gemmologists, antique dealers, collectors and wildlife conservationists worldwide.

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

GEM-A ONLINE

Top stories from the Gem-A blog

Diamond Up for Auction: Exceptional 6.16ct Farnese Blue diamond for sale

Jurassic Jet: A Look to the Past to Preserve the Future

Birthstone Guide: Emerald for those born in May

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

EDUCATIONAL WORKSHOPS

Whether you are a retailer, gem dealer, buyer, valuer, auctioneer or gemstone enthusiast, our workshops are designed to give students a thorough gemstone and diamond education in a short amount of time. Our range of 'Understanding' workshops offer students a hands-on introduction to the world of gemmology and diamonds, allowing them to learn new skills or brush up on the basic.

Workshops take place at Gem-A headquarters, 21 Ely Place, London from 10:00-16:30 where all gemmological equipment is provided. Our upcoming workshops are:

Understanding Gemstones
20 August 2018

Understanding Practical Gemmology
21 August 2018

Understanding Diamond Grading
30 August 2018

Understanding Diamond Simulants
31 August 2018

For more information contact the Educational Department via: education@gem-a.com

Price: £135 for Gem-A members, students and NAJ members; £165 for non-members

Ready for Summer

Evocative of the summer months, we explore the vibrant colours of watermelon tourmaline and ask gemmologist, Rebecca Tsang, to reveal the story behind this heart-shaped specimen.

Heart Watermelon Tourmaline. Image courtesy of Rebecca Tsang.

"Because of tourmaline's trigonal symmetry, I always thought it would be interesting if there was a specimen out there with the shape of a heart. This watermelon tourmaline specimen was acquired at the Tucson Gem and Mineral Show in February 2016, but the actual country of origin is unknown. It was found in a small tray labelled 'watermelon tourmaline $3'. My search ended with this heart-shaped specimen with a point and a distinctive cleft.

The face-up appearance of the slice under overhead lighting was not as appealing as I imagined, but after trying out different viewing directions, its beauty finally shone through in front of the exhibit hall ceiling lights. When I got home, I decided to capture this beauty with diffused light shining from the back to bring out the contrast in colour and diaphaneity of this beautiful watermelon heart."

ELBAITE

Chemical Composition: $Na(Al_{1.5}Li_{1.5})Al_6(BO_3)_3[Si_6O_{18}](OH)_4$

Hardness: 7-7.5

Cleavage: Difficult, indistinct

SG: 3.0 to 3.1

RI: 1.62 to 1.65

DR: 0.014 to 0.021

TOURMALINES, from the Singhalese words *tura mali* 'stone with mixed colours' are a chemically complex group of silicate minerals. Most multi-coloured forms are elbaite, which crystalise in a trigonal system – usually prismatic – with pyramidal terminations.

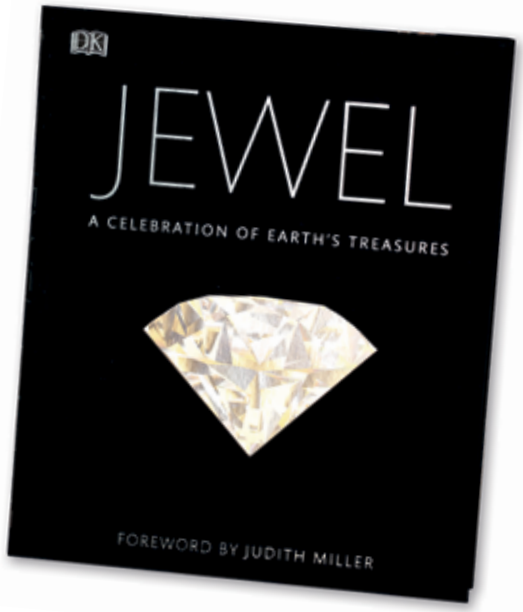
The distinctive watermelon tourmaline occurs when elbaite crystals are found in the same stone; as the crystal grows it is exposed to different minerals (such as manganese and lithium) and develops concentric colour-zoning: from a red/pink centre, through a pale zone, to a green 'rind-like' exterior.

Gem-A INSTRUMENTS

Current Gem-A members and students get a 20% discount!
Quote: Gems&Jewellery

SPECIAL OFFER

TREASURES FROM THE EARTH



Featuring incredible stories about some of the world's most famous gems including the Koh-i-Noor diamond, stunning Fabergé eggs, and the mysterious Hope diamond, Gem-A Instruments assistant, Sophie Cox, delves into the pages of *Jewel: A Celebration of Earth's Treasures*, published by DK.

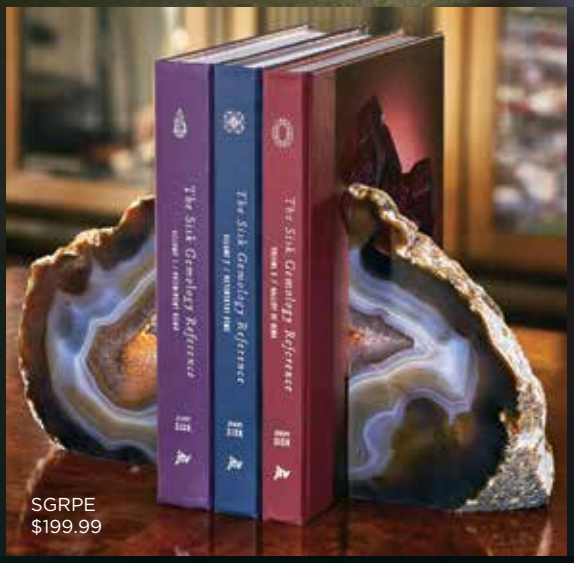
Encased in a luxurious velvet cover, this vibrant coffee table book offers an illustrated guide to the origin, chemical composition, appearance and properties of gemstones, with striking photography and detailed sub-chapters on historic jewels owned by royalty throughout history — including a pelican brooch worn by Queen Elizabeth I, and a Cartier Flamingo brooch worn by Wallace Simpson, the Duchess of Windsor.

The book begins with an informative introduction by antiques expert Judith Miller, of the BBC's *Antiques Roadshow*. Miller is a contributor to various newspapers, including the *Financial Times* and the *Daily Telegraph*, and a lecturer at London's V&A museum and the Smithsonian Institution in Washington DC. Her foreword kicks-off a book that is packed with information, historic case studies, helpful snippets and, above all, pictures that will impress even the most seasoned gemmologist.

Divided into 'Native Elements', 'Gemstones', 'Organic Gems' and 'Rock Gems & Rocks', the book covers everything from the Crown of Charlemagne to gems for anniversaries, marble, granite, ammolite, jet and the Dom Pedro Aquamarine. Most importantly, this book is accessible and captivating to both gemmology students, professionals and those who appreciate jewellery artistry and craftsmanship.

Whether you are buying for yourself, or as a thoughtful gift, Gem-A Instruments is offering a 20% discount, allowing you to immerse yourself in a world of jewels, precious metals and exceptional gemstones for just £20. If you've ever wanted to know more about the Stuart Sapphire, the Maharaja's Patiala necklace, Queen Desideria's malachite parure or the Russian amber room, now's your chance!

***Jewel: A Celebration of Earth's Treasures, with Foreword by Judith Miller (DK)* is originally priced at £25.00. Price with Gem-A 20% discount: £20.00.**
If you require any further information, advice or simply to make a purchase then please email instruments@gem-a.com ■



SGRPE
$199.99

The Sisk Gemology Reference

by Jerry Sisk

Professional Edition

A comprehensive and visual gemology resource featuring prominent and noteworthy gemstones.

jtv® jewelry love

jtv.com/sgr