

Gems & Jewellery

Sept/Oct 2016 / Volume 25 / No. 5



Interview
with John Dyer

The Crown Jewels

Advanced testing on jet



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OF GREAT BRITAIN



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Sept/Oct 2016

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Interview with John Dyer

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Cover Picture

John Dyer's flame-cut citrine, first place winner in the 2015 German Award for Jewelry and Precious Stones in Idar-Oberstein. Photo by Lichtblick Foto-Design, Hiltrud & Jurgen Cullmann of Schwollen, Germany.

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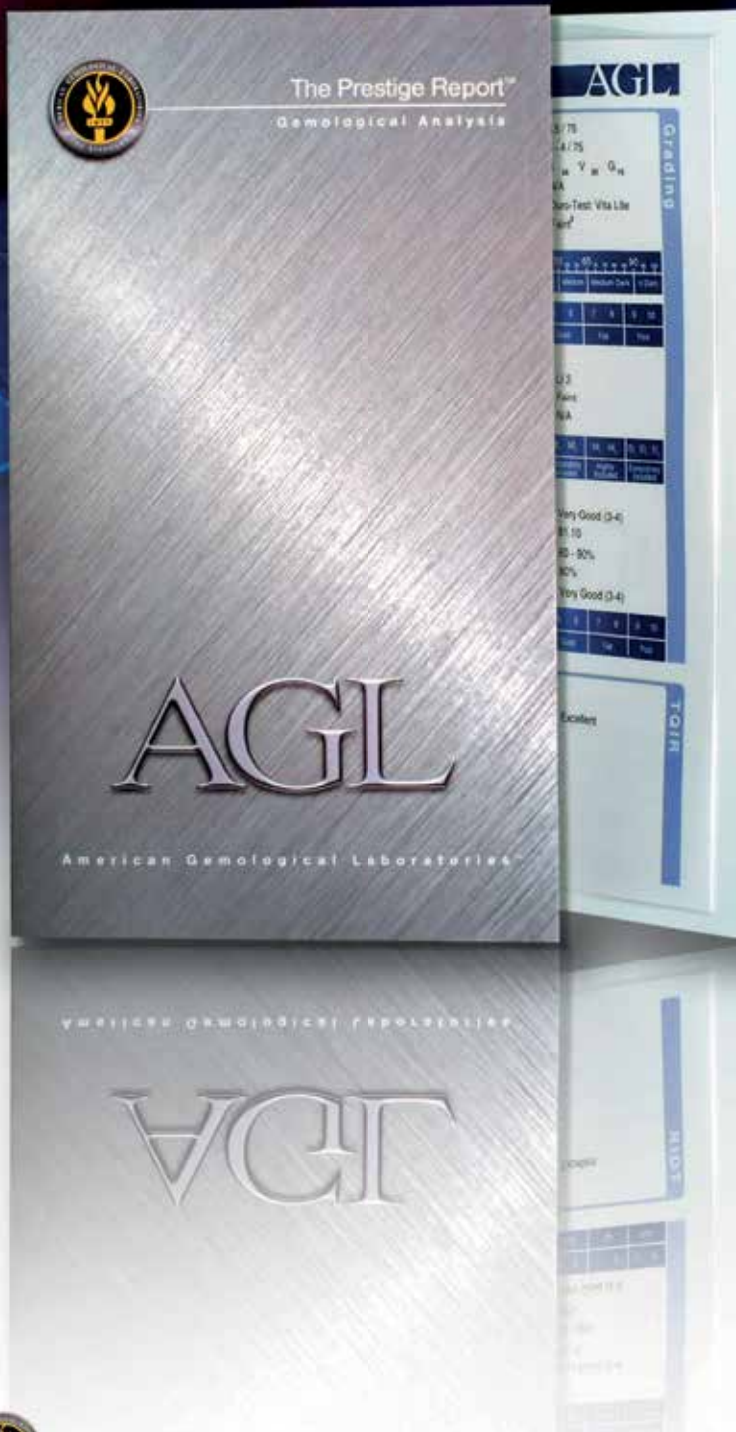
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Cultivating community

September is just around the corner and all at Gem-A are busily preparing for the upcoming Autumn trade shows. Whether running workshops, giving seminars or marketing our business, for most of September Gem-A will be spread around the globe: we will be attending IJL from 4–6 September in London, the Hong Kong Jewellery & Gem Fair from 15–19 September in Hong Kong, the Denver Gem & Mineral Show from 16–19 September in Denver, Colorado, and the IRV Loughborough Conference from 17–19 September in Loughborough. See pages 11–13 for previews of the Hong Kong Jewellery & Gem Fair and IJL.

There is little over two months left until the Gem-A Conference, one of the highlights of the Gem-A calendar. We have already secured some fantastic sponsors, and we are thrilled to announce that once again Jewelry Television (JTV) will be our Platinum Sponsors of the Conference. We would like to thank JTV for their support over the last few years. In the coming weeks we will announce our full line-up of sponsors — if you would like to sponsor please contact events@gem-a.com or visit our website to view the brochure. All at Gem-A are looking forward to the Conference; we have a fantastic line-up of speakers, workshops and trips available — for more information please visit pages 17–20. If you haven't booked your tickets and you're planning to attend make sure you sign up soon — places on the trips and workshops sell out quickly and booking for the whole Conference closes on 21 October.

I am settling in to daily life at Gem-A, and have been pleased with what I've seen. The staff are working hard to sign up new students ready for the September classes and are planning and preparing for shows, as well as signing up new members whilst assisting our current members. We are just about to launch a new Gem-A Instruments catalogue — a great improvement on our older versions. Over the coming months I want to look carefully at our branding and assess how we can establish a new, modern 'feel' to Gem-A, whilst also utilising our strong historical brand to its full potential. We have many ideas to discuss.



[GemTalk] will be the perfect place for members and students to get together to discuss gemstones, treatments and issues or advances in the trade, as well as the place to ask questions and provide answers, or simply to chat with like-minded gemmologists in a safe online community.

With that modernization, the biggest news in the last couple of months is the new Gem-A website, launched on 1 August. We have been working on this project for a long time, and are thrilled that it is now finally live. If you have a spare moment please drop by and check it out, but do bear in mind that parts of the website are still under construction and that we are still polishing certain areas. We are working towards full delivery of these areas soon — keep checking back regularly. If you do have any problems accessing the website or suggestions for improvement please drop us a line at webadmin@gem-a.com. The launch of the website also heralds the return of GemTalk, in its new form as a moderated, online 'global forum'. This will be the perfect place for Members and Students to get together and discuss gemstones, treatments and issues or advances in the trade, as well as the place to ask questions and provide answers, or simply to chat with like-minded gemmologists in a safe online community. Why not drop by GemTalk and introduce yourself? I really hope this will flourish into a great online community, and be a 'go to' place for members and, indeed, anyone interested in gemmology.

Lastly, Gem-A's Annual General Meeting (AGM) is just around the corner. The AGM will be held on 9 September at The Goldsmiths' Centre, Britton Street, London. More information on the candidates for the Council can be found on page 8. Please check the Gem-A website to view the 2015 Accounts, Minutes of the 2015 AGM, and to download all proxy forms for voting. It would be great to see as many of you there as possible; please remember, as members this is your Association, and you have a voice through your vote.

I wish you all a wonderful few months ahead and look forward to meeting many of you at Gem-A, at shows around the world and/or at the Gem-A Conference in November.

With very best wishes,

Alan Hart FGA DGA
Chief Executive Officer ■

Gem News

RIO TINTO RELEASES COIN WITH RED DIAMOND

Rio Tinto has unveiled the world's first coin to feature a rare red diamond from its Argyle mine in Western Australia.



Known as the Kimberley Treasure, the 'investment piece' is for sale with a price tag of AU\$1 million (US\$762,280). Made from 1 kg of 99.99% fine gold, it features a radiant cut 0.54 ct red diamond. The mine produces on average 1 ct of red diamonds per year, Rio Tinto said.

The coin is issued as legal tender under the Australian Currency Act 1965, which is collaborating with the Perth Mint to release the coin.

Simon Trott, managing director of Rio Tinto's diamond business, said: "[The coin is a] beautiful symbol of the unique treasures of Western Australia and sets a new benchmark in limited edition craftsmanship."

WDC APPOINTS NEW PRESIDENT

Andrey Polyakov has been elected to the position of president of the World Diamond Council (WDC). He has served as vice president of the WDC since 2015 and now succeeds Edward Asscher, whose two-year term as president concluded in May this year.

On his appointment, Polyakov commented: "I look forward to working closely with the Board of Directors and the membership of the WDC, on behalf of our great industry, through the WDC's critical role of representing the industry at the Kimberley Process. I am confident that joint efforts and a willingness to dialogue among all parties will enable us to achieve success in strengthening our industry's reputation." He added: "The diamond's value and worth is measured in its symbolism. It invokes a sense of permanence, obligation, passion and loyalty. These are the same values that we as Council members bring to the task at hand and I look forward to upholding the integrity of these values as the steward for positive change during my term as president."

As the most senior executive officer, Polyakov's role will be to continue the mission of the Council and to further

protect the integrity and reputation of the Kimberley Process.

Polyakov has also served as ALROSA's vice president since 2013, responsible for client policy. He also acted as one of the initiators of the creation of the Diamond Producers Association (DPA), and is now a founding member of the DPA Board.

RARE GEM NAMED AFTER MINERALOGIST

'The world's rarest gem' has been named 'kyawthuite', after the mineralogist who purchased the precious stone at a market in Mogok, Myanmar. Last year the International Mineralogical Association (IMA) recognized the precious stone bought by U Kyaw Thu in 2010 as a distinct and, currently, singular mineral specimen. It is currently being exhibited at the Natural History Museum of Los Angeles County.

The stone — a reddish orange in colour and weighing 1.61 ct — was originally found by

gem prospectors in Myanmar's famed 'Ruby Land'. Not realizing its uniqueness, the finders set the raw stone out for sale at a market, where U Kyaw Thu saw it and discerned something special. Confirming its rarity was difficult in Myanmar, so he cooperated with experts from the US and the IMA.

RAPAPORT TO OFFER NATURAL UNTREATED DIAMOND MELEE

Rapaport Auctions and Trading offered clients the opportunity to purchase parcels of melee that were 100% natural and untreated in its sale last month. Every single diamond in these parcels was tested using the latest Gemological Institute of America (GIA) equipment and testing technology. In addition, Rapaport offers parcels that were statistically sample tested at a 99% significance level to a 1% tolerance level.

Rapaport Auctions will continue to offer regular non-tested parcels of diamonds. All auction buyers that buy non-tested diamonds will be able to have suitable diamonds tested before taking delivery from Rapaport. ■

NEW VEIN OF BLUE JOHN DISCOVERED



The first new vein of the rare mineral Blue John to be discovered in 150 years has been found by accident. The mineral, also known as Derbyshire spar, was found in the Peak District by miner Gary Ridley while he was testing a new stone chainsaw.

The new find, dubbed 'Ridley Vein' after its discoverer, emerged at the Treak Cliff Cavern tourist attraction. "It was only because we were trying out a new method of mining using a stone chainsaw that we discovered it," said Mr Ridley. "I decided to try the new saw in an area of the cavern we've never dug before... just off the tourist route. I couldn't believe my eyes when, within a few minutes, I had uncovered a substantial deposit."

Historically there have been 14 distinct veins of Blue John, with the Ridley Vein now entering the record books as variant number 15. Dr Trevor Ford, a retired senior lecturer in geology at Leicester University and an expert on the mineral, said the find was a "major new development". In 2013, miners rediscovered a 'lost vein' of Blue John after more than 70 years.

Gem-A News

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



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WELCOME TO GEM-A: THE WORLD'S OLDEST SCHOOL OF GEMMOLOGY

NEW GEM-A WEBSITE LAUNCHED

The new Gem-A website was launched on 1 August 2016. In a post on the new GemTalk, a web-based global forum, Alan Hart, Gem-A CEO, said: "The new site delivers vast improvements on our previous one, and, as we become fully live and operational over the coming months, will be user friendly and inspiring to our many audiences. We have worked hard to deliver an improved interface and provide better access to Gem-A services for our members, the wider gemmological community and anyone interested in pursuing our leading gemmology courses." The new global forum is a replacement for the old MailTalk system. It will be easy to use and will provide an online meeting point for the collective expertise, questions and discussions — a fantastic resource and service.



NEW DEVELOPMENTS IN GEM-A EDUCATION

The new academic year starts in September, and is looking to rolling out a range of exciting new resources over the coming year. With growth comes a responsibility to ensure we provide our students with the right support they need in order to achieve their goals and ambitions and so Gem-A has dedicated additional funding and resources into education in order to achieve this aim. Our education administration team has already expanded and from September we are welcoming Pavet Amrit FGA DGA as our new ODL

support and Student Welfare Officer. This is a very important role and will provide extended support to our tutors across all study options: on-site, Online Distance Learning (ODL) and at our worldwide Accredited Teaching Centres (ATCs). This is one of the best ways we can support students worldwide, and will allow us to provide more in-depth care to students studying with us. Part of the role will also involve reviewing and expanding our online education resources and their accessibility, which will be developed alongside Gem-A's new website and members' area. Together these developments will create a much

more robust and extensive source of information and communication links for both members and students.

ANITA BEARDWOOD JOINS GEM-A EDUCATION TEAM

We are also delighted to announce that Anita Beardwood joined our education team in August as maternity cover for Natalie Harris. Anita has been a regular attendee at Gem-A's conferences over the years. Anita is a keen gemmologist with a strong educational background, having worked with the Canadian Gemmological Association for the last 16 years. ■

Gem-A AGM 2016

Kerry Gregory FGA DGA discusses the upcoming AGM, to be held at The Goldsmiths' Centre, Britton Street, London from 18:00 on Friday 9 September.

The time is fast approaching for Gem-A's Annual General Meeting (AGM). Until last year the AGM was a small, quiet event with a handful of members attending in order to elect the Gem-A Council. Last year saw a larger number of members attend, however, and it was great to see so many people involved in the voting and election process — we would love to see the same or higher levels of involvement this year.

Whilst the function of Gem-A as a charity is to further gemmology education for all, we are also deeply committed to you, our members, and want to know what you want from your Council and Association. One way you can make us aware of this is by making sure you vote at the AGM. There are also other ways you can make us aware, and we actively encourage feedback from our members — email chair@gem-a.com with your thoughts. We would like to see as many members as possible vote in the upcoming elections — we are hoping that the voting fever stirred up by 'Brexit' in June in the UK (as well as the presidential elections in the

U.S.) will encourage all members worldwide to have their say.

As per our Memorandum and Articles the nearest number to a third of the longest-serving Council members must retire by rotation. This year retirement falls to Nigel Israel FGA DGA and Mary Burland FGA. Mary Burland is retiring without standing for re-election. Miranda Wells FGA DGA resigned from the Council and her position as Chair on 26 July due to pressure of work. These two incredible members have put an enormous amount of work into the Association over the years, and as a Council we would like to extend our genuine and heartfelt thanks to them both for everything they have done, willingly and tirelessly, and always with the best interests of the Association and members in their hearts and minds. In addition to the aforementioned, Kathryn Bonanno FGA has been selected by lot to retire to fulfil the quota required. This is due to all other board members being elected at the same time last year at the elections.

As a result of the Special Resolution passed at the recent EGM, this leaves us with two places on the Council to be filled. Both Nigel Israel and Kathryn Bonanno offer themselves up for re-election, along with Ronnie Bauer FGA and Starla Turner FGA, who have been nominated to stand by members of the Association. Most of you will know who these people are as they are all very active in our industry, as well as within the Association, and all would like the opportunity to help support and drive the Association forward. If you would like further information on the members standing for election or about the current members of the Council (Justine Carmody FGA, Paul Greer DGA, Kerry Gregory FGA DGA, Alan Hodgkinson FGA DGA, Jack Ogden FGA, Richard Slater FGA DGA and Chris Smith FGA), please visit the Gem-A website (www.gem-a.com) for biographies of all prospective and current Council members.

Lastly, also retiring this year is the incumbent president Harry Levy FGA. It is difficult to put into words the support Harry has given to the Association during his time in office; his experience and wisdom (not to mention his wealth of stories about the gem and diamond trade) have been such a benefit to all of us at Gem-A. The Council wish to extend their gratitude to Harry for all the good that he has done. Whilst there is not a person on earth who can replace Harry (if you have met him you will know he is a one-off!), the Council have selected organics expert Maggie Campbell Pedersen to take the mantle. Maggie is not only a well-respected and fine gemmologist, but has also given so much to the world of gemmology and to the Association. We believe she is the ideal person to represent and help guide the Association over the coming years.

Aside from the important business of electing members of the Council, the AGM is also an opportunity for members to meet each other and to network and socialize, as well as to meet the new Gem-A CEO Alan Hart, along with members of staff, to ask them any questions you may have. We hope to see many of you there. ■

Kerry Gregory is a vice-chair of the Gem-A Board of Trustees, a Gem-A ODL tutor and manager of Gemstones and Specialist Jewellery Department at H&T Pawnbrokers. An enthusiastic hands-on gemmologist, Kerry has been a member of the Association for over 14 years.





Gem-A

THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN

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MEMBERSHIP
REGISTER

1939 - 1956

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ASSOCIATION
MEMBERSHIP
REGISTER

1957 - 1974

Annual General Meeting 9 September 2016

All current paid-up members are invited to come along and have their say at our AGM, to be held on Friday 9 September 2016 at The Goldsmiths' Centre, 42 Britton Street, London. Doors open from 18:00 for 18:30 start.

To download the AGM Notice, Agenda, Annual Report and Accounts please login to the Gem-A website and visit the Membership Resources area.

Creating gemmologists since 1908

Join us.



Events

GEM-A EVENTS

Gem-A AGM 2016

9 September

The Goldsmiths' Centre, Britton Street, London
Gem-A's Annual General Meeting will take place at The Goldsmiths' Centre, London. Doors open 18:00 for 18:30 start.

Gem-A Conference 2016

5–6 November

RIBA, Marylebone, London

Gem-A returns to the prestigious RIBA building for their annual gemmological conference. Featuring a host of internationally-renowned speakers, this event is not to be missed. See pages 17–20 for detailed information on speakers, events and how to book.

Gem Central

Fluorites with Claire Mitchell

30 August

Please check the Gem-A website for the latest information. If you are interested in attending this event please register your place with events@gem-a.com.

Price: Free for Gem-A members and students
£10 for non-members

OTHER EVENTS

Midlands Branch — The Staffordshire Hoard

30 September

Fellows Auctioneers, Birmingham

Pieta Greaves will visit the Midlands Branch to discuss the Staffordshire Hoard. For more information please contact the Gem-A Midlands Branch Chairman, Georgina Kettle, at georgekettle@hotmail.com.

Students: £4 Gem-A Members: £6

Non-Members: £8

Midlands Branch — Tourmalines

28 October

Fellows Auctioneers, Birmingham

Michael Hügi will discuss the nature and formation of pegmatites, and will include details of his recent visits to the tourmaline mines of Mount Mica (USA) and the Neuschwaben mine (Namibia).

Students: £4 Gem-A Members: £6,

Non-Members: £8

UPCOMING SHOWS

International Jewellery London (IJL) 2016

4–6 September

Stand J10, Olympia, London

Gem-A returns to the UK's biggest jewellery show. Come and visit the team at J10 to learn more about our courses and purchase equipment. See pages 12–13 for more information.

Hong Kong Jewellery & Gem Fair

15–19 September

Stand 3M044, Hong Kong Convention & Exhibition Centre, Hong Kong

Similarly to previous years, Gem-A will join forces with ATCs across Hong Kong to promote our world-renowned education and membership packages. We will be situated at stand 3M044; visit us to browse our selection of books and instruments. We look forward to meeting our ATCs, students and members during the event. See page 11 for more information.

Denver Gem & Mineral Show

16–19 September

Denver Mart Expo Hall, Denver, Colorado, USA

Gem-A joins the Denver Gem & Mineral Show from 16–19 September to investigate the show's main theme for this year: African Minerals. This is the 49th show and the second that Gem-A has exhibited at. Our North American manager, Eric Fritz, looks forward to seeing you there!

IRV Loughborough Conference 2016

17–19 September

Loughborough University, Loughborough

A firm favourite with gemmologists and valuers, the IRV Conference is not to be missed. Visit www.jewelleryvaluers.org/ Loughborough-Conference for more information.

Rough Diamond Workshop

11 October 2016

£150 Gem-A Members and students

£180 non-members

Are you interested in rough diamonds? Why not attend our **Rough Diamond Workshop**, an exclusive one-day workshop delivered by **Dennis Terry**, an independent rough and polished diamond consultant. Terry, currently Rough Diamond Valuer for the UK Government Diamond Office, has a wealth of knowledge on rough diamonds. You will learn a basic understanding of rough diamonds and the diamond industry as well as a practical grounding in the handling and recognition of the various diamond qualities, shapes and colours. The workshop also covers related topics including conflict diamonds, KPCS Certification and rough diamond valuation and pricing theory.

For more information or to book your place contact education@gem-a.com.

Please note: Previous knowledge in diamonds is essential (such as Gem-A's Diamond Grading & Identification Certificate or attendance at one of Gem-A's one-day diamond workshops).



Midlands Branch — Scottish Gemstones

25 November

Fellows Auctioneers, Birmingham

Alistair Tait will discuss Scottish gemstones. More information to follow.

Midlands Branch — Diamond Imitations

24 February

Fellows Auctioneers, Birmingham

Gwyn Green will discuss diamond imitations. More information to follow.

Hong Kong Jewellery & Gem Fair 2016

Gem-A will once again return to the Hong Kong Convention & Exhibition Centre for the 34th Jewellery & Gem Fair from 15–19 September 2016. As the world's premiere jewellery event, this is a fantastic opportunity for our Asian community to

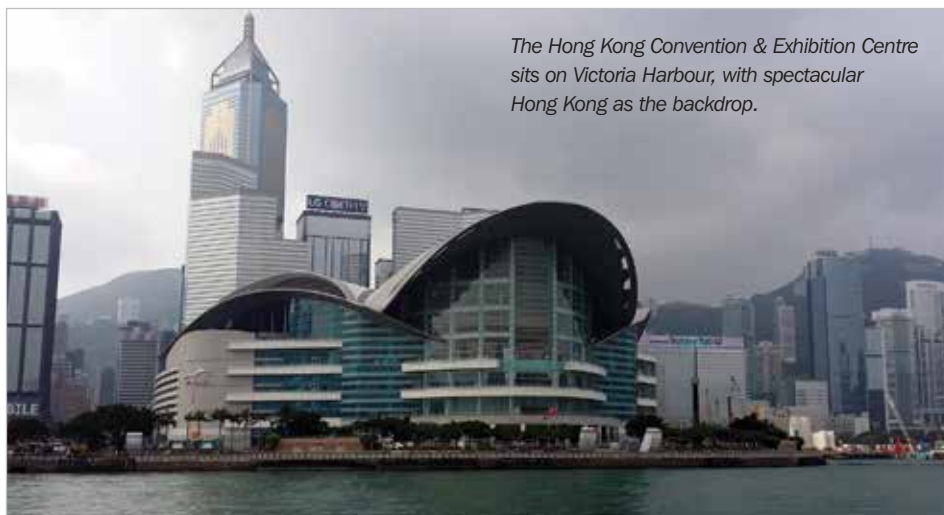
get together in one place and meet the team. If you are a Gem-A Member or Gem-A Student planning to attend the show, stop by the Gem-A stand (3M044) to meet our new CEO, Alan Hart FGA DGA, and to test or purchase our top-quality

Where: Stand 3M044,
Hong Kong Convention
& Exhibition Centre

When: 15–19
September 2016

instruments, including darkfield loupes, portable polariscopes, microscopes and our new Specific Gravity Kit. We will also have a selection of books available for you to browse and buy. Come and have a chat with our dedicated team, who will be happy to answer any questions that you have, or sign up for one of our world-class gemmology courses. We are also looking forward to meeting with some of our many Accredited Teaching Centres (ATCs) in Asia.

With heavy representation from key players in the trade, the Hong Kong Jewellery & Gem Fair is an event not to be missed. Focusing on fine finished jewellery, popular zones include the Fine Design Pavilion, Hong Kong Premier Pavilion, International Premier Pavilion, Designer Arena and Jadeite Gallery. In 2015 the fair featured over 3,750 exhibitors from 50 countries, and welcomed over 57,000 visitors from around the world. We look forward to seeing you there! ■



The Hong Kong Convention & Exhibition Centre sits on Victoria Harbour, with spectacular Hong Kong as the backdrop.



Gem-A
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ONLY AT HK JEWELLERY & GEM FAIR

20% off portable polariscope with torch

This portable polariscope with torch is supplied with movable polaroid discs, rotating stone holder and zip case – perfect for the travelling gemmologist.

Please note: The torch requires 2 x AA batteries (not supplied). This item cannot be used for gemstones set in jewellery.

For prices please visit the Gem-A stand 3M044

* Offer only available at HK Jewellery & Gem Fair 2016. No other discount applies. Postage and packing not included.





IJL 2016

The UK's biggest jewellery show is back for its 61st year. As proud supporters of International Jewellery London (IJL) 2016, Gem-A will be joining a host of suppliers, manufacturers, associations and trade bodies for a three-day jewellery extravaganza in London's famous Olympia.

Come and meet the team on Stand J10, where you can experience hands-on practical demonstrations with the spectroscope and loupe, as well as view inclusions through the microscope. Gem-A Instruments will be selling top-quality equipment, and you can also talk to our friendly team about our

world-famous gemmology and diamond courses, find out how Membership of the Association can benefit your career or simply sign up for one of our popular one-day workshops — useful practical days to help you learn the basics of gemmology or to help you brush up on your gemmological skills.

We will also be hosting a number of free workshops and seminars in conjunction with IJL to ignite your passion for gemmology.

IJL is composed of seven sections, including Fine Jewellery, Designer Brands, Silver Jewellery, the Design Gallery, Gems, Loose Diamonds and Precious Gems, Watches and Jewellery Retail Services and Solutions. IJL also features a host of educational seminars and interviews (including two seminars hosted by Gem-A's Claire Mitchell and Julia Griffith, as well as an exclusive interview with Alan Hart), 'Ask the Expert' advice clinics, the IJL Catwalk and several initiatives, including KickStart, aimed at sponsoring up-and-coming designers in the Design Gallery, and Bright Young Gems, an initiative renowned for unveiling future stars in the contemporary jewellery world — both sponsored by IJL and the NAJ.



Where:
Stand J10,
Olympia, London

When:
4–6 September 2016

Events

'In Conversation With' Alan Hart

Sunday 4 September

Inspiration Theatre, 11:00

Gem-A CEO, Alan Hart, has been invited on stage to participate in IJL's latest feature: 'In Conversation With'. Alan will be interviewed by Sarah-Louise Jordan, where he will discuss his plans for Gem-A. There will be an opportunity to ask questions.



Gem-A Seminars

Ruby or not ruby? That is the question!

Sunday 4 September

London Room, 12:30–13:30

Lead-glass-filled rubies are a prevalent 'treatment' commonly used in today's jewellery industry. They are arguably glass-ruby composites that have hit the market in their millions and are often sold as 'natural' gems. Gem-A tutor, Julia Griffith, will help you to explore this 'treatment' of ruby and will discuss accurate identification techniques. Examples will be provided for hands-on practical experience. Numerous samples will be available for attendees to view during the seminar.

Separating similar-looking stones

Tuesday 6 September 2016

London Room, 10:00–11:00

How often do you glance at a gemstone or piece of jewellery and wonder what the gemstone might be? As gemmologists we all 'sight ID' from time to time but what if you have several stones similar in appearance sitting in front of you? Can you still separate them out visually?

Throughout this practical session, Claire Mitchell, Teaching Manager at Gem-A, will explore several groups of similar-looking stones and show which hand-held tools can be used to separate them. This is a useful exercise with lasting results. ■



RELAUNCH OF GEM EMPATHY AWARD

Gem-A's annual Gem Empathy Award has been relaunched. The award, open to all those exhibiting in the Design Gallery at this year's IJL, will be

presented at the show. In previous years the award has been presented to the IJL exhibitor displaying, in the opinion of the judges, a single piece or collection of jewellery that makes captivating use of one or more gemstones. This year, however, the criteria for the Gem Empathy Award has changed. Gem-A will provide a breathtaking 10.46 ct Fantasy Cut heliodor (pictured, also known as golden beryl), sourced from award-winning gem cutter John Dyer, around which applicants will be encouraged to create a design that they feel shows the stone to its best advantage.

The judging panel will be made up of four representatives from Gem-A and IJL, and will evaluate submitted designs based on the relationship between stone and design, the practicality and the style and beauty of the overall design.

The winning designer will receive the stone in order to create the piece, which Gem-A hopes to display at one of their prestigious events between 2016 and 2017.



Gem-A
INSTRUMENTS

ONLY AT IJL

20% off girdle inscription and hearts and arrows viewer

This handy inscription viewer features an adjustable 20× loupe and a rotating ring holder, making it ideal for reading laser inscriptions on the girdle of a diamond. The base also contains a removable hearts and arrows viewer and a viewing plate for loose stones.

Please note: The item will be black, not blue as shown.

Was £40+VAT

Now just £32+VAT*

* Offer only available at IJL 2016. No other discount applies. Postage and packing not included.



Tales from the Tower

Andrew Fellows FGA DGA takes a look some of the myths and legends associated with one of the world's most famous gem collections, the Crown Jewels.



Tower of London at night. Copyright Kjetil Bjørnsrud (Own work).

Gem-A Conference attendees are once again being given the exclusive opportunity to have a private viewing of the Crown Jewels at the Tower of London — one of the most famous gem collections in the world. No visit to the conference, or even just to London itself, would be complete without a visit to see the collection.

Foundations were laid for the Tower as early as 1066 by William the Conqueror, with successive monarchs adding to and reinforcing the Tower, until, by the late thirteenth century, the general layout still seen today was established, although further expansion was undertaken in later years. The Crown Jewels, the only working collection in Europe, is comprised of over 141 objects, which have been stored securely within the Tower for hundreds of years. It is these that attract hordes of tourists each year. However, whilst the collection is worth seeing simply for the sheer beauty of the pieces, it is also worth seeing to learn about the captivating stories and histories behind some of the gems.

The Imperial State Crown (pictured) — possibly the most well-known individual piece of regalia in the collection — is worn by the monarch at the end of his or her coronation ceremony, and is also used for the State Opening of Parliament. The Crown is such an important piece that it even has its own coach for these important occasions — one that is every bit as ornate as the crown itself. Weighing in at an impressive 3.17 kg, it can only be worn for short periods. One story says that when George IV was crowned in 1821, he developed a toothache that he blamed on the weight of the crown! The crown contains some of the most important jewels in the Royal Collection, many of which also have the most interesting stories attached to them.



The Imperial State Crown. Copyright Cyril Davenport.

One story that most gemmologists are familiar with is that of the Black Prince's Ruby. This is simultaneously one of the most beautiful and most sinister stones... and one which is also completely misnamed! Although referred to as ruby, this is actually a very large gem-quality red spinel, presented to Edward of Woodstock, a fourteenth century Prince of Wales, Duke of Cornwall, and Prince of Aquitaine, referred to more often as 'The Black Prince'. The gem, which sits in the cross pattée above the Cullinan II at the front of the crown, has a very dark and bloody history. It was first recorded in the fourteenth century as being owned by a Moorish Prince, Abu Said, who attempted to surrender to the conquering forces of Pedro the Cruel. Abu Said was ambushed under a flag of truce and executed with this large spinel being taken from his corpse. This was just the start of the trail of blood, as Pedro himself broke several contracts, before presenting the stone to Prince Edward as a down payment for military assistance. The remainder of the payment was supposed to consist of treasure and jewels, but was never delivered, and eventually Pedro himself was ambushed and stabbed to death by his half-brother.

The stone was later worn in the battle helmet of Henry V when he went into the Battle of Agincourt in 1415, and allegedly saved his life when he received a blow to the head from an axe — one which destroyed the helmet, but didn't kill Henry. The 'ruby' was recovered from the shattered helmet and remained with Henry V until his death. The same unfortunately cannot be said of Richard III, who also wore the 'ruby' in his battle helmet when he fought at the Battle of Bosworth Field in 1485. Presumably, Richard thought it would protect him and

bring him luck, but sadly he was mistaken and died on the battlefield. This same ruby was later used in the crowns of Henry VI, Edward IV and Henry VIII (who wore it in a collar), before being sold by Charles I. It was returned to the monarchy for the crown of Charles II, and was subsequently used for the coronation of George IV.

Also in the Imperial State Crown is a sapphire, set in the cross on top of the Crown. Legend has it that this sapphire once resided in the coronation ring of Edward the Confessor, and that one evening he was passing through Westminster when he happened upon a beggar. Having already given away all the money he had on him, he gave the ring to the beggar and thought nothing further of it. Years later two Englishmen were on a pilgrimage to the Holy Land and, in the middle of a violent storm, saw an old man approaching them. When the old man heard that the two men were English, and that Edward was still King, the old man offered them shelter for the night. When they departed the next morning, the old man revealed himself to be John the Evangelist, and told them that years ago King Edward had given him a ring, which he

No visit to the conference, or even just to London itself, would be complete without a visit to see the collection.

The Cullinan was found at the Premier Mine in South Africa, on the afternoon of 26 January 1905, by the mine superintendent, Captain Frederick Wells. Initially he doubted it was a diamond as it weighed 3106 ct and measured $3\frac{7}{8} \times 2\frac{1}{4} \times 2\frac{5}{8}$ inches, well over twice the size of any other diamond found to that date. This was sold to the Transvaal government for £150,000, and two years later the still uncut diamond was presented to King Edward VII on his 66th birthday.

Cutting of the stone was a job given to I.J. Asscher and Company, of Amsterdam, who had some experience of cutting large diamonds, although nothing on this scale or value. After three months of consideration, the Cullinan was ready to be cut. In those days the only way to divide a diamond was

and is set into the front of the Imperial State Crown. It also has two platinum loops on its setting, so that it can be removed and worn alone, as a brooch or pendant, or with the Cullinan I accompanying it.

A second notable diamond exists in the Queen Mother's Crown, this being the Koh-i-Noor, which translates as 'Mountain of Light'. This impressive diamond currently weighs 105.6 ct, having been recut from its original 186 ct for Queen Victoria in 1852. There is a legend that this stone will bring good luck to any woman who wears it, but a curse to any man! It is said that in 1739 Nadir Shah of Persia conquered the Mogul region, but could find no sign of this rare and fabled diamond, said to be held by the rulers, until one member of the royal court told him of the stone's location. Shah then threw a celebration, and offered to exchange turbans with the conquered leaders as a show of everlasting friendship, knowing that this was the hiding place of the Koh-i-Noor. The diamond changed hands many times over the coming decades, until in 1850, the Koh-i-Noor finally found its way to England and to Queen Victoria, where it has remained ever since.



The nine major uncut stones split from the rough Cullinan diamond in order of size (largest to smallest).

still had, and gave it to them to return to the King, with a message that he, John, would see the King in Paradise as a reward for his kindness in six months' time. When the two men returned to England, they gave both the ring and the message to King Edward, who immediately prepared for his death. The King died six months later, to be buried with the ring on his finger. Stranger still is the fact that when the tomb was reopened in the twelfth century, the ring was found on a perfectly preserved corpse.

Whilst some of these stories are merely legend and may or may not be true, what is known as fact is that the Crown Jewels contain some of the best known and largest diamonds in the world, the most famous of which are probably the Koh-i-Noor and the Cullinan.

by cleaving it — effectively 'hitting' the stone in precise directions to cause the diamond to part along weaker directions, but this had to be done carefully, in order to avoid shattering it. Careful cleaving resulted in nine major 'pieces' (pictured), and 96 offcuts. Once the whole cutting process was completed, a total of 1063 ct remained. The nine major stones, named Cullinan I to Cullinan IX, all reside in the Royal Collection. The majority are set in such a way as to be interchangeable into other pieces of jewellery.

Cullinan I, also known as the Star of Africa, is in the Royal Sceptre, and weighs just over 503 ct, making it the largest colourless pear-cut diamond in the world. The Cullinan II (the 'Lesser Star of Africa'), is the largest cushion-cut diamond in the world, weighing 317 ct,

Whilst the Crown Jewels are a wonderful piece of English history, they are also shrouded in legend, and are more than just adornments. There are a multitude of stories and histories, all waiting for visitors to uncover. Whether you appreciate them from a gemmological or historical perspective, or simply want to see jewels that most of us will never afford, the Crown Jewels are the perfect way to spend a day in London. ■

Attendees of the Gem-A Conference have the opportunity to book a trip to see the Crown Jewels at the Tower of London on Tuesday 8 November. This popular event is usually the first to sell out, so book now. To book your tickets for the Conference visit <http://bit.ly/2adl1jT>.

The Journal of Gemmology

Guy Lalous ACAM EG summarizes two articles from Volume 35 Number 2 of *The Journal of Gemmology*.

Additional summaries from this issue were included in the July/August issue of *Gems&Jewellery*.

Major- and Trace-element Composition of Cu-bearing Tourmalines*

Summary of 'Major- and Trace-element Composition of Paraíba-type Tourmaline from Brazil, Mozambique and Nigeria' by Martin Okrusch, Andreas Ertl, Ulrich Schüssler, Ekkehart Tillmanns, Helene Brätz and Hermann Bank.

Tourmaline's extreme compositional variability is responsible for its multitude of colours. Copper-bearing tourmalines are highly prized for their vivid coloration.

Radiant blue-to-green gem-quality tourmalines were discovered in 1987 in granitic pegmatites in Paraíba State, Brazil. Polarized absorption spectra of dark blue Paraíba tourmaline display strong pleochroic absorption bands with maxima at ~700 and ~920 nm due to Cu^{2+} , and at ~520 nm due to Mn^{3+} . Spectra of light blue Paraíba tourmaline show only the Cu^{2+} absorptions with no Mn^{3+} band.

Cu-bearing elbaite was found in the mid-2000s in the eastern Alto Ligonha pegmatite province, Mozambique. Heating of purple-to-violet samples from Mozambique can result in a vivid 'turquoise' blue colour, typical of Paraíba-type tourmaline.

In 2001, green, blue and blue-violet to amethyst coloured tourmalines containing Mn^{3+} and Cu^{2+} were discovered in Nigeria. Upon heating the violet crystals from Nigeria, the absorption band of Mn^{3+} is reduced and the absorption bands typical of Cu^{2+} become obvious.

In this paper, the major and trace elements of some gem-quality Cu-bearing tourmalines (e.g. blue, greenish blue, yellowish green, green, violet and pink) from Brazil, Mozambique and Nigeria were analysed using an electron microprobe. In addition, B, Li and several trace elements, including rare-earth elements, were analysed by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Most of the tourmalines contained significant



The light greenish blue gems in this 12-piece suite of Mozambique Cu-bearing tourmaline (30.66 carats total weight) have been heated, while the others are unheated. Courtesy of Palagems.com; photo by Mia Dixon.

amounts of Cu, Mn or a combination of both. Blue colour was in most cases due to Cu^{2+} . Pink and violet coloration (due to Mn^{3+}) was shown by Mn-bearing tourmalines that contained no significant Fe. Green colour in the Nigerian tourmaline was most probably due to a combination of Mn, Cu and Fe. Some of the green samples from Brazil contained up to 0.6 wt.% V_2O_5 . Among the trace elements, remarkable contents of Pb (up to 4,000 ppm) and Bi (up to 2,900 ppm) were detected rarely in samples from all three countries.

Chemical analysis revealed that the tourmalines from the three countries are virtually Mg-free and Fe-poor elbaite. Highly variable amounts of $\text{Cu}^{2+} \pm \text{Mn}^{2+} \pm \text{Mn}^{3+}$ are the main chromophores. The authors conclude that there is no clear-cut correlation of the Cu and Mn contents with coloration. Based on a comparison of unheated pink and violet samples with data for blue Paraíba-type tourmalines, $\text{CuO}/\text{MnO}_{\text{tot}}$ is usually ≥ 0.5 for unheated blue samples. The authors suggest that blue Cu-bearing tourmalines with $\text{CuO}/\text{MnO}_{\text{tot}} < 0.5$ may have been heat treated to reduce the contribution of the reddish component of Mn^{3+} .



These gems show the bright coloration of Cu-bearing tourmaline from Brazil. The blue gems (top) weigh 1.87 and 1.49 ct, and the greenish blue to bluish green stones (bottom) weigh 2.80 ct (centre stone) and 2.51 carats (total weight of matched pair). Courtesy of Palagems.com; photos by Mia Dixon.

* A summary of an article published in *The Journal of Gemmology*, 35(2), 2016, 120–139.



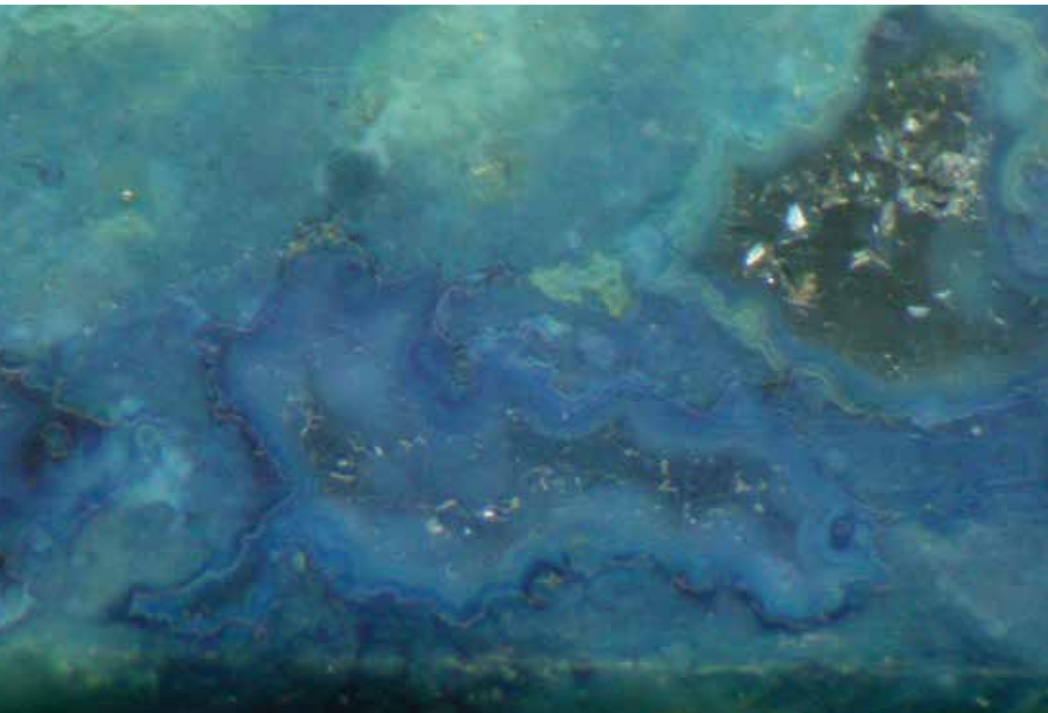
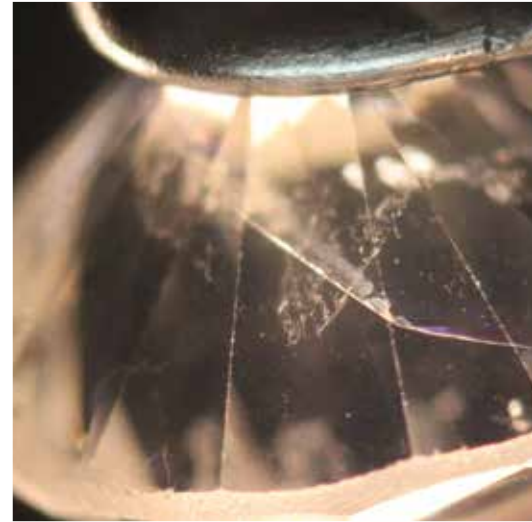
Gem-A

THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN



Gem-A Conference 2016

Saturday 5 and
Sunday 6 November



SPEAKER PROGRAMME

Following on from the success of last year, Gem-A will return to the Royal Institute of British Architects (RIBA), Marylebone, on 5–6 November, to host its internationally acclaimed annual conference. Welcoming speakers from around the globe, the Gem-A Conference has a reputation for tackling the most innovative and contemporary gem-related topics, whilst bringing together leaders in the field for a weekend of networking and special events.



SATURDAY 5 AND SUNDAY 6 NOVEMBER

Gem-A Conference

Jarvis Auditorium, Royal Institute of British Architects (RIBA), Marylebone, London

Located in the heart of Marylebone, near to Regent's Park and Oxford Street, this architecturally significant venue was opened in 1934 as the headquarters of RIBA.

SATURDAY PROGRAMME

Ian Harebottle

The critical role of colour and design in ensuring the future of the jewellery sector

Jim Clanin

The fundamentals of mining for coloured gemstones and mineral specimens

David Fisher

Progress in the detection of diamond treatments

John Dyer

The science and the art of gem cutting

Robert Weldon

In Peter Rainier's footsteps: journey to the Chivor emerald mine

SUNDAY PROGRAMME

Helen Molesworth

The history of gemstones

Dr Michael Wise

Hiddenite emerald deposits of North Carolina

Danny Sanchez

Photomicrography of inclusions

Pat Daly

Identification techniques

Bill Larson

Gemstones and gem mining in San Diego County, California

WORKSHOPS AND TRIPS PROGRAMME



SATURDAY 5 NOVEMBER (EVENING)

Gem-A Conference Dinner

Florence Hall, RIBA, Marylebone, London

Drinks reception for 18:30, dinner for 19:15

Saturday's programme will be followed by a drinks reception and a three-course dinner where you can relax and enjoy the company of friends old and new. Dress code is smart/casual.

MONDAY 7 NOVEMBER

Workshops

Gem-A Headquarters, Ely Place, London

Two practical workshops will take place at Gem-A Headquarters in London.

Guest workshop hosts:

- 🌐 **Richard Drucker FGA GG, President of GemWorld International Inc.**
'Coloured stone grading and pricing workshop'
- 🌐 **Alan Hodgkinson FGA DGA**
'Visual optics'
- 🌐 **Michael Hügi FGA NEW**
'Inclusions in gemstones: what they tell us'



MONDAY 7 NOVEMBER (EVENING)

Graduation Ceremony and Presentation of Awards

The Royal College of Surgeons, Lincoln's Inn Fields, London

Graduates of the Gemmology Diploma and Diamond Diploma and their families are invited to attend the 2016 Graduation Ceremony and Presentation of Awards. The ceremony will be followed by a drinks reception in the Hunterian Museum and Surgeon's Library for graduates and guests.



TUESDAY 8 NOVEMBER

Private viewing of the Natural History Museum's mineral collection

Natural History Museum, London

09:45-12:00

Explore this breathtaking collection with a private viewing, hosted by Alan Hart FGA DGA, Gem-A CEO and former Head of Earth Sciences Collections at the Natural History Museum.

Book soon; places are limited at this popular event and always sell out quickly.



Private viewing of the Crown Jewels

Tower of London, Tower Hill, London

18:00-19:00

You will be taken on a tour of the Tower of London, one of London's finest landmarks and steeped in history, finishing with a private viewing of the Crown Jewels. You will be able to stop and admire each piece on this fascinating tour.

Book soon; places are limited at this popular event and always sell out quickly.

BOOKING

Bookings for the Gem-A Conference can be made using Eventbrite.

To book please visit <http://bit.ly/2ad1j1T>

If you are a Member or Student you will need a promotional code to access special rates. If you have not received this code please contact events@gem-a.com. Booking will close on Friday 21 October 2016 and no bookings will be accepted after this date. Priority for workshop and trip bookings will be given to conference attendees. Please select a maximum of one trip and one workshop per booking.

Event	Date	Price
MEMBER RATE		
Two-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 and Sun 6 November	£250.00
One-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 OR Sun 6 November	£135.00
STUDENT RATE		
Two-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 and Sun 6 November	£100.00
One-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 OR Sun 6 November	£50.00
NON-MEMBER RATE		
Two-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 and Sun 6 November	£295.00
One-day Conference attendance (not including Saturday evening Conference dinner)	Sat 5 OR Sun 6 November	£150.00
SATURDAY EVENING DINNER		
3-course evening dinner at RIBA with drinks reception	Sat 5 November	£75.00
WORKSHOPS		
Half-day session with Richard Drucker	Mon 7 November (Morning OR afternoon)	£25.00
Half-day session with Alan Hodgkinson (Max. 8 people per session)	Mon 7 November (Morning OR afternoon)	£25.00
NEW Half-day session with Michael Hügi	Mon 7 November (Morning only)	£25.00
TRIPS		
Mineral Collection at the Natural History Museum	Tues 8 November (09:45)	£25.00
Crown Jewels at the Tower of London	Tues 8 November (18:00)	£45.00

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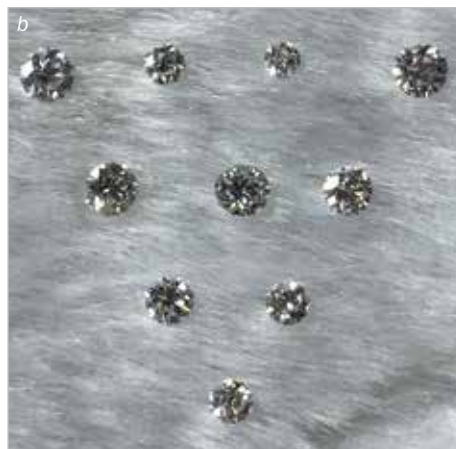


Are Colourless HPHT-grown Synthetic Diamonds the Next Chinese Commodity?*

Summary of 'Identification of Colourless HPHT-grown Synthetic Diamonds from Shandong, China' by Zhonghua Song, Taijin Lu, Shi Tang, Jie Ke, Jun Su, Bo Gao, Ning Hu, Jun Zhang, Jun Zhou, Lijun Bi and Dufu Wang.



The samples included (a) 10 colourless crystals (0.26–0.67 ct) and (b) 10 colourless faceted HPHT-grown synthetic diamonds (0.06–0.19 ct) from Jinan Zhongwu New Materials in Shandong, China. Photos by Z. Song.



This study discusses colourless rough and cut high-pressure, high-temperature (HPHT)-grown synthetic diamonds produced by Jinan Zhongwu New Materials Co. Ltd. (Jinan, Shandong), which employs about 70 domestically made cubic HPHT presses.

The crystal samples were subjected only to microscopic examination and photoluminescence (PL) spectroscopy; they showed a combination of cubic and octahedral forms, sometimes with small faces corresponding to {110} and {113}. The cut samples had colour grades up to D–E and clarity grades up to VS₁. The lower clarity grades contained numerous irregular-shaped metallic inclusions. As a consequence, some of the samples were attracted to a magnet. The specimens showed very weak anomalous birefringence with low-order interference colours between crossed polarizers. They displayed weak yellow fluorescence and no phosphorescence when exposed to long-wave UV radiation. The reaction to

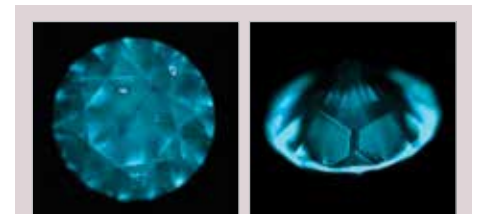
short-wave UV radiation was medium-to-strong yellow-green fluorescence with green phosphorescence. DiamondView imaging revealed distinct cuboctahedral growth sectors and produced greyish blue fluorescence and strong greenish blue phosphorescence.

The only element detected by energy dispersive X-ray fluorescence spectroscopy was Fe, which was likely the dominant solvent/catalyst used during the growth process. It was difficult to detect useful signals from Raman PL spectroscopy of the faceted samples, regardless of the laser excitation wavelength. A weak 883/885 nm doublet related to Ni was found with the 785 nm laser in four specimens. Weak 737 and 637 nm emissions were recorded in some of the crystals and a 692/693 nm doublet was detected in all of them. The assignment of this doublet has yet to be determined.

UV-Vis spectra recorded a weak absorption at 270 nm associated with isolated nitrogen. There also was a weak general absorption

due to boron in the near-infrared region. All samples proved to be mixed types Ib and IIb with variable boron content. Fourier-transform infrared (FTIR) spectra showed boron absorption features located at 4090, 2800 and 1290 cm⁻¹. A weak line at 1332 cm⁻¹ and bands at 1075 and 960 cm⁻¹ were observed in all samples. The 1332 cm⁻¹ feature has already been detected in boron-doped synthetic diamonds and in those grown using a Ni-containing solvent/catalyst, and has been attributed to N⁺.

HPHT growth technology has made significant progress in the last few years, and colourless HPHT-grown synthetic diamonds are becoming more common in the marketplace. A combination of a reduced amount of N (which causes yellow coloration) and controlled content of B (which produces blue colour that neutralizes the yellow caused by isolated N) gives the synthetic diamond a colourless overall appearance. These samples are not a gemmological challenge; they can be reliably identified with a combination of FTIR, UV-Vis, microscopy and luminescence imaging techniques. ■



In the DiamondView, the Shandong HPHT synthetic diamonds showed greyish blue fluorescence (here, seen in two views of a 0.14 ct sample). The cuboctahedral growth sector is also evident. Photos by Z. Song.

* A summary of an article published in *The Journal of Gemmology*, 35(2), 2016, 140–147.

Advanced jet testing

Sarah Steele FGA DGA reports on her recent visit to the Centre for Research and Restoration of Museums of France to test jet samples using advanced Ion Beam Analysis (IBA) techniques.



1: Photo shows one of the Whitby Jet samples within its stratigraphical context.

As gemmology students we learn about the various gem testing techniques of X-ray powder diffraction (XRD), X-ray fluorescence (XRF) and Fourier transform infrared spectroscopy (FTIR), and so on. However, few of us will ever have the opportunity to have hands-on experience of testing our own gemstones in a laboratory, and perhaps even fewer of us will ever be required to produce primary research data within our own specific fields of interest. This, however, was exactly the position I found myself in, when as a geologist working full time as a lapidary in Whitby, I started to question the published data I saw on jet. These questions initially spurred me into studying Gem-A's Gemmology and Diamond Diplomas, during which time I became aware that little research had been completed into the chemistry of jet. I was keen to look at the nature of jet as a material and to see whether the differences that we see in the stability and durability of Whitby Jet, as well as in foreign jet samples, was reflected in the geochemistry of the material itself. It became clear that I needed to do some advanced testing of the material in order to produce a diagnostic spectrum from a range of advanced laboratory instruments. However, at the time, this kind of advanced research was beyond my reach as an amateur gemmologist.

Fast forward several years and my problems were solved by help from an unexpected source. Following my jet workshop in May 2016 at the Scottish Gemmological Association's Conference in Peebles, I was approached by the National Museum of Scotland to supply them with samples of Whitby Jet, to be included within a current research project the museum were completing into their collection of Bronze Age jet. The aim was to attempt to establish provenance of the samples, as many articles have been written on trade routes from Whitby to the rest of the British Isles during Early Prehistory, and the museum were keen to explore the usage of Whitby Jet at this time by examining their samples from that period. The National Museum of Scotland had applied for (and successfully been awarded) a slot to test their jet artefacts at the Centre for Research and Restoration of Museums of France, located underneath the Louvre in Paris, and they needed guaranteed samples of Whitby Jet as controls for their testing. Having explained to Dr Alison Sheridan, a Principal Curator

of the National Museum of Scotland, that I could not simply provide one single piece of Whitby Jet that could adequately represent the resource as, in my opinion, a wide range of geochemistry existed, she suggested that I join their team, providing samples to be tested over the week allocated.

The testing methods being used were unknown to me. Coming under the category of Ion Beam Analysis (IBA), they included Particle-induced X-ray emission (PIXE) and Particle-induced gamma-ray emission (PIGE), as well as Rutherford backscattering spectrometry (RBS) techniques.

I selected 80 samples of jet, the majority being systematically collected from the Whitby stratigraphy by myself and colleagues (1), as well as samples including Asturian jet from Spain, and those from Georgia, Siberia, Mongolia, Turkey, Lithuania, New Mexico, and (thanks to Alan Hodgkinson) China, Pennsylvania and Canada.

Arriving at the Louvre, I made my way past the glass pyramid and was directed to a discreet flight of stairs leading down to the research facility. It became apparent almost immediately that this was a part of the Louvre that the general public would never see. Some 15 metres beneath tourists' feet is housed the Accélérateur Grand Louvre d'analyse élémentaire (AGLAE). Commissioned in 1989, AGLAE has long been the only facility of its kind in the world to be placed in a museum laboratory. I was advised that the AGLAE is a small particle accelerator (2) — I was beginning to feel like I was in a Dan Brown novel!

Along with my colleagues from the National Museum of Scotland we were shown around the lab by Thomas Calligaro, a permanent researcher at the facility. He explained to us that the principle of IBA techniques relies upon the detection of the products of the interaction of an ion beam of a few megaelectron volts (MeV, equal to one million electron volts; an electron volt is the energy an electron acquires by moving through a potential difference of 1 V), with the target — in this case, the gem. Among these techniques, PIXE is similar to XRF as it is based on the detection of X-ray emitted by the target atoms, subsequent to an inner-shell ionization. The only difference stems from the excitation source, which is a charged particle beam (proton) instead of an X-ray beam. In PIXE the X-ray emission occurs



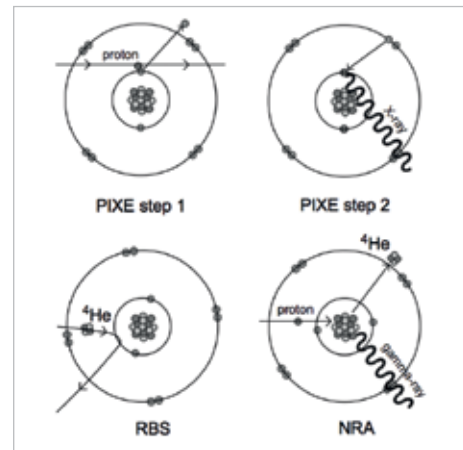
2: Sarah Steele and the small particle accelerator. The gamma-ray detector is cooled to -200°C using liquid air.



3: Photo shows Whitby Jet sample positioned in front of proton beam and detectors.



4: Layout of the AGLAE external microprobe: 1) focusing coil, 2) exit nozzle, 3) Si(Li) detector for 1–15 keV range, 4) Si(Li) detector for 5–40 keV range, 5) charged particle detector for RBS/NRA, 6) Peltier-cooled X-ray detector for monitoring the beam dose using the PIXE signal emitted by the Si₃N₄ exit foil. Courtesy of Thomas Calligaro, AGLAE Research Facility, Centre for Research and Restoration of Museums of France.



5: Diagram showing the physical principles of IBA techniques. Courtesy of Thomas Calligaro, AGLAE Research Facility, Centre for Research and Restoration of Museums of France.

almost without background, therefore this method has a very good sensitivity (reaching the microgram/gram or $\mu\text{g/g}$ level for the transition elements, which are implied in the colouring mechanism of gems). The lightest measurable element depends on the ability to detect low energy X-rays. With a minimum X-ray energy set to 1 kilo electron volt (keV), PIXE can measure all elements starting from sodium. PIXE is a two-step atomic process involving 1) an inner shell ionization of the target atom by the incoming ion 2) the filling of the subsequent electronic vacancy by an outer shell electron and the release of excess energy by emission of a characteristic X-ray.

For the PIGE technique, there is no such conventional counterpart as for PIXE. PIGE is based on a nuclear reaction between the incident particle and the nucleus of a target atom. Following this reaction, the nucleus emits a γ -ray with a specific energy. This reaction occurs when the incident particle is able to surmount the Coulomb repulsive barrier of the nucleus, a situation mainly met for light target atoms (more specifically Be, Li, B and F when using a proton beam). Therefore, PIGE usefully extends the range of PIXE (from Na to U) to these elements.

METHOD

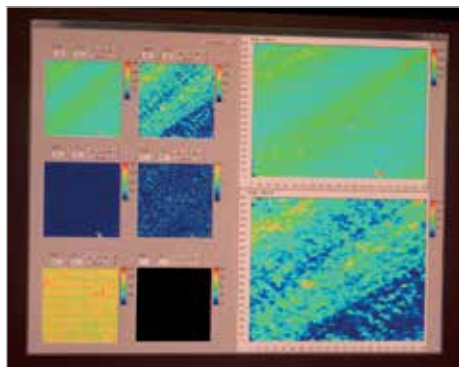
PIXE is a two-step process: an inner-shell electron of the target atom is expelled by the impinging ion, then follows an electronic rearrangement accompanied by X-ray emission. RBS relies on a purely elastic process based upon the electrostatic repulsion between positively charged projectile and target nuclei. Nuclear reaction analysis (NRA), as in PIGE, occurs when the projectile and the target nuclei come close enough to undergo a nuclear reaction with emission of characteristic photons or charged particles. Along their path, the protons disturb the electron cloud of a large number of atoms or initiate nuclear reactions with light elements (3, 4). The highly sensitive technique of the RBS is based on the measurement of particles that bounce back (they are said to ‘backscatter’) as a result of collisions with heavy nuclei. Shown in 5 are the physical principles of IBA techniques.

From a gemmologist’s perspective, the IBA methods present several benefits. First, in-air IBA techniques performed with an external beam allow *in situ* and non-destructive analysis of gems without any sample preparation. The lack of the need for sample

preparation and the mainly non-destructive nature of the testing is a significant advantage when testing historical gems. Moreover, the availability of a micro-beam with a size of less than 20 μm permits to select inclusions for their identification, depending on their depth. Such a small probe is also useful to select an inclusion-free region of the crystal. Indeed, with a broader spot size, there is always the risk that an inclusion incorporated in the analysed area may bias the mean trace element concentration of the crystal (e.g. an ilmenite FeTiO_3 inclusion in a ruby might lead to a wrong Fe and Ti mean concentrations).

The proton beam used to test the samples is generated by AGLAE. Thomas explained that this huge machine (some 10 metres long) is used to focus the proton beam using magnetic lenses to a diameter equivalent to the width of a finger down to to a diameter of 20 μm . The proton beam travels at up to 10% of the speed of light and is impinging on the gem placed in air 2 mm downstream a very thin Si_3N_4 exit foil, which ensures the air/vacuum interface. The detection of X-rays is achieved by two Si(Li) detectors located at 45° from the beam in the horizontal and vertical planes. The first one is dedicated to the measurement of light elements, which are often the major constituents of gems (from Na to Fe). With a 10 mm^2 active area, it has a low solid angle, and a minimal filtering using an ultra-thin window combined with a helium flow. A magnetic deflector prevents backscattered protons of the beam from entering the silicon crystal. The second detector is dedicated to the measurement of heavy elements (from Ca to U) at the trace level. Its 50 mm^2 active area yields a large solid angle and the absorber is

chosen to attenuate X-rays emitted by major elements (typically a 50 µm aluminium foil in case of Si-containing samples). The distance of the two detectors can be adjusted to optimise and balance their counting rates. Gamma-rays are collected using a third detector (high purity germanium with a 20% efficiency). The beam is monitored using the silicon X-ray line emitted by the Si₃N₄ exit foil by means of a compact Silicon-drift detector. Spectra are collected in 1,000 seconds with a beam current of the order of 1 nA, yielding an integrated charge of about 1 µC.



6: Photo shows results of PIXE mapping of Whitby Jet sample showing lack of chemical homogeneity when considering Ti, Fe, Zn, Zr and S.

TESTING

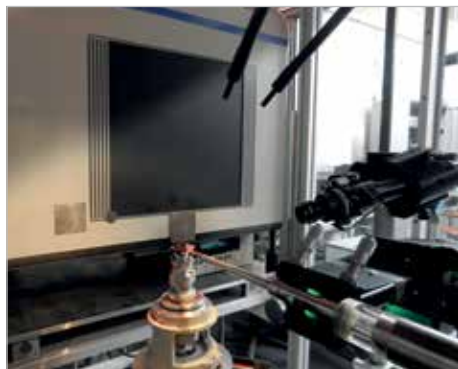
After the initial calibration of the machine was completed using coal samples of known elemental composition, we began testing the Whitby Jet samples. Three spot tests on the first sample gave three very different results; one showing a high zinc content, whilst another measured a zinc concentration below the level of detection. It was decided to extend the test area using a surface mapping technique. A 4000 × 4000 µm area map was selected and after 20 minutes we began to see the first insight into the true nature of Whitby Jet. Despite being amorphous and appearing homogenous, it became clear that we are looking at a material which is chemically far from homogenous, explaining our previous three different spectrums for one sample (6).

I was elated to see that my opinion as to the nature of jet had been confirmed by the results of the experiment at least for this first sample tested, but the experimenters then realized that this was going to make our research into jet much more complex. I proposed in line with other researchers that the banding we were observing appeared to be a reflection of the growth rings of the wood precursor that we often see in

I am confident that this pioneering analysis, coupled with my ongoing research, will give us a new understanding into this little understood gem group, and help to protect one of Britain's most iconic gemstones from poor quality simulants.

hand specimens of jet, so depending on the orientation of our sample we were mapping either along or across the grain of the original wood prior to fossilization. The chemical homogeneity of the mapped areas could therefore vary significantly with orientation. This unfortunately had not been a consideration as the samples had been prepared in labs of the National Museums of Scotland Collections Centre prior to this experiment, furthermore we did not have time to prepare new specifically-orientated samples (7). As we continued mapping other samples it became clear that general patterns were beginning to emerge for the jet samples depending on geographic location. RBS was used to achieve a quantitative measure of carbon in the samples, which we will, investigate to determine if it could be used as a diagnostic feature when trying to establish origin for jet materials.

A discussion evolved regarding the physical nature of elemental anomalies that PIXE was detecting. Chemical data alone is sometimes insufficient to define the nature of a material. We know that jet is amorphous, but we questioned whether our results actually reflected the presence of microscopic crystalline structures within the fabric of the material as previously reported — pyrite, hematite or ilmenite perhaps? Thomas suggested that chemical data should be combined with structural information



7: Photo shows a jet sample orientated in position using laser crosshairs. The XRD spectrum is collected by the screen behind.

delivered by complementary techniques, such as XRD or Raman spectroscopy.

Whilst the mapping continued we were able to utilize the lab's brand new piece of kit: an XRD machine. The archaeological importance of the samples tested within the lab are such that any method of analysis used must cause negligible damage, hence this was the perfect instrument as this non-powder XRD machine is non-destructive. Using XRD some of our foreign jet samples showed evidence for the presence of crystalline quartz and pyrite, which, in the case of Asturian jet came as no surprise, as the presence of pyrite within the fabric of this jet causes instability. Our Whitby Jet samples however were much more complicated and may hold some new discoveries for science!

After finishing the analysis on the rough jet samples we also tested 20–30 artefacts from the museum collections. It will take six weeks before we have the complete results from all tests; the physicists and engineers are working to calibrate the data — keep a look out in *Gems&Jewellery* for the results. Hopefully some of the artefacts will be confirmed as Whitby Jet, although my experience of visually identifying Whitby Jet tells me that many of these artefacts will be confirmed as not so.

GEMMOLOGISTS AND IBA

I asked Thomas why more gemmologists weren't using IBA as a testing technique and was surprised by his answer. It turns out that the AGLAE facility spends a lot of time testing gemstones, but these are stones that are archaeologically and culturally important. Prior to testing my jet samples he had just completed testing of the cloisonné garnets of the Staffordshire Hoard. Previously they have used AGLAE to check whether a scabbard given to Napoleon Bonaparte by the French government was actually cast in solid gold (it was) and to identify the minerals in the hauntingly lifelike eyes of a 4500-year-old Egyptian sculpture known as 'The Seated Scribe' (transparent rock crystal and white magnesium carbonate veined with thin red lines

of iron oxide). They have also carried out over 500 PIXE analyses on rubies from the most important occurrences: Afghanistan, Myanmar, Cambodia, India, Kenya, Madagascar, Sri Lanka, Thailand and Vietnam. In the case of emeralds, work has been carried out to establish the origin of the 'Barbarian Visgoth' emeralds of the middle ages, compared to those from various occurrences in Egypt, Austria, Afghanistan, Pakistan, Ural, India, Colombia, Madagascar, Zambia, Zimbabwe and Brazil, on the basis of chemical composition.

IBA is, Thomas says, "a perfect tool well suited to the analysis of gemstones mounted on historical jewels, complementary to more traditional gemmological investigation techniques. The combination usefully provides: 1) a completely non-invasive and non-destructive analysis, 2) the detection of a wide range of elements, 3) the analysis of 10 µm size details, 4) a high sensitivity attaining the µg/g level and 5) highly quantitative results. It is possible the identification of mineral inclusions could be achieved by a technique like Raman spectrometry.

To say that I thoroughly enjoyed my week working at the Louvre is an understatement. It was a once in a lifetime opportunity, and such a privilege to think that my jet samples

had followed the Staffordshire Hoard and Napoleon's scabbard into the path of that proton beam. I am confident that this pioneering analysis, coupled with my ongoing research, will give us a new understanding into this little understood gem group, and help to protect one of Britain's most iconic gemstones from poor quality simulants. It was great to think that the Centre for Research and Restoration of Museums of France so

strongly shared my belief that Whitby Jet is of such cultural importance to the British Isles that they were prepared to carry out this testing which would have otherwise been financially impossible for me to achieve. ■

All photos copyright Sarah Steele.

All diagrams and technical data courtesy of Thomas Calligaro.

ACKNOWLEDGEMENTS

I would like to thank the following for helping me collect the jet samples: Norman Robinson of Robinson's Jet, Richard Bunting of Abbey Jet, Mike Marshall of Yorkshire Coast Fossils and Peter Wilson, a private collector. Thanks also go to Dr Alison Sheridan, Principal Curator of Early Prehistory, National Museum of Scotland; Dr Lore Troelen, Collection Centre, National Museum of Scotland and Thomas Calligaro of the AGLAE Research Facility, Centre for Research and Restoration of Museums of France.

The grant for the testing in Paris was provided as part of the Integrated Platform for the European Research Infrastructure ON Cultural Heritage (IPERION CH).
<http://www.iperionch.eu/iperion-vision>

FURTHER READING

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The life and work of Fred Ward

Andrew Fellows FGA DGA takes a look at one of the most revered series of gem books and the fascinating life of its author.

Frederick Newman Ward, otherwise known as Fred Ward, the renowned photographer and world famous author of the beloved Fred Ward Series of gemstone books, sadly passed away on 19 July at the age of 81. During an illustrious career Fred inspired thousands of people with his style of writing and photography, and for one will count his passing as a great loss to gemmology.

Fred started his career as a journalist and photographer, contributing to titles such as *Time*, *Newsweek*, *Life* and *National Geographic*, and capturing iconic photographs of legends such as Martin Luther King, John F. Kennedy and The Beatles. His passion for photography saw Fred equip himself with skills such as flying a helicopter and scuba diving, in order to be able to take a wider scope of pictures. He worked freelance for *National Geographic*, visiting over 130 countries between 1964 to 1992. His interest in gemmology peaked later in life, although he did have a passion for stones from early on. It was his work at *National Geographic* that was the stepping stone for Fred into the world of gemmology — initially writing and photographing for a series of shorter gemstone articles, Fred discovered a talent and passion for gems in all their



forms, and from this beginning the series of world-renowned books, some written with his wife Charlotte, was born.

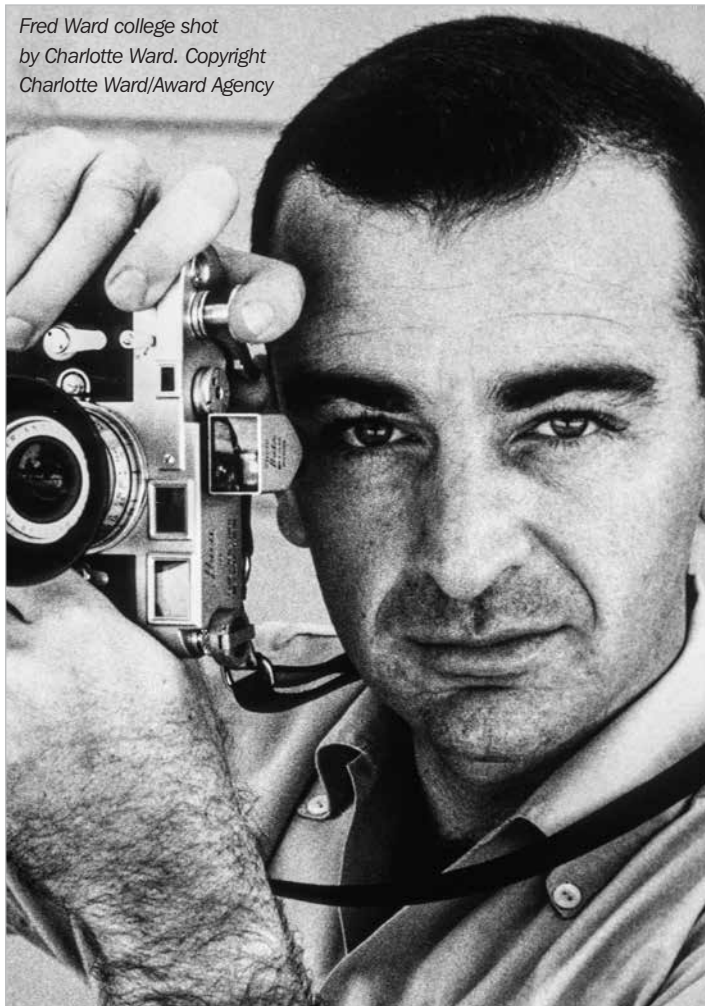
To me, the series of books (comprising the titles *Diamonds*, *Emeralds*, *Gem Care*, *Jade*, *Opals*, *Pearls*, *Phenomenal Gems* and *Rubies & Sapphires*), based on a simple idea premise belies its success: write a short- to medium-length book that covers all aspects of the stone in question, but do so in such a way that the reader is captured from page one. Add to this specially taken photographs, tied intrinsically into the text, and you have a winning formula. Although the series only consisted of eight titles, I am almost certain that at least one of Fred's books can be found in nearly every gemmologist's library.

Each of the titles produced has undergone several revisions through the years, bringing the reader up to date with every new development or source. The styles have been refreshed with new photographs, sourced specifically by the author during his extensive travels. Most of the localities and collections mentioned throughout the series were visited personally by Fred to gather firsthand knowledge.

In *Jade*, Fred sets out on the unenviable task of introducing and explaining the complex materials that fall under this group (these being jadeite and nephrite) and distilling over 5,000 years of history and culture into little over 60 pages. This he manages to do, covering such areas as the history and lore, not only in general terms, but also from the numerous different cultures that have revered jade over the centuries. China, New Zealand and Canada are discussed in economic and cultural terms, along with their impact on the global market. In relatively simple but engaging sections, Fred captures the essence of this ancient gem, proving that a book doesn't need to be weighed down with scientific facts and figures to be informative. Many of those who purchase this book say it provides a good grounding in the subject and dispels many of the myths that this is a stone only really understood in the Far East. Having undergone three editions, with the latest only recently released, this is a very current and useful addition to the library, and a fitting memorial to the author.

In *Emeralds* Fred provides an informative and readable journey through the history of this popular stone. From its history in Egypt and the famous Cleopatra Mines through to the Spanish conquest of South America and the opening up to the world of the now

Fred Ward college shot
by Charlotte Ward. Copyright
Charlotte Ward/Award Agency



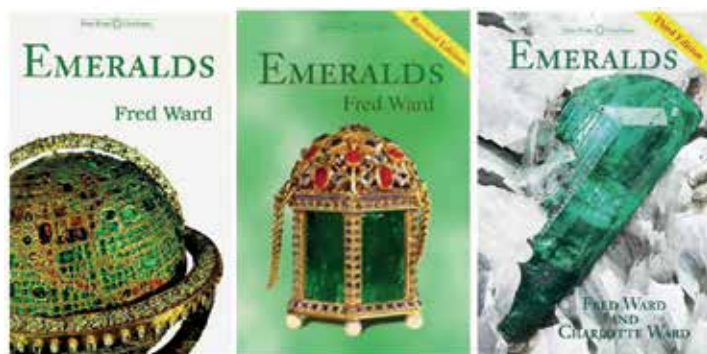
famous Muzo mine and Colombian sources, Fred captivates the reader, drawing in not only seasoned gemmologists, but hobbyists and retailers with his stories of famous and beautiful stones and objects, each lavishly photographed. Images such as the Topkapi Dagger draw the eye, whilst carefully phrased text implants knowledge of treatments such as oiling, without the dryness that could easily have accompanied it.

When writing on pearls, Fred maintains his approach as in previous texts, and although many other authors have produced weightier tomes on the subject, he managed to produce in a little over 60 pages a complete overview of the whole pearl industry. From historic natural sources through the experiments of Mikimoto into the now common culturing processes, also covering imitations and treatments, Fred carries the reader on a journey of discovery, regaling with tales of treasure and royal collections, and first-hand experiences of the current market.

Opals was a volume that was quickly updated soon after publishing with the advent of a new opal find, showing how dedicated Fred was to keeping abreast of new developments. Through field trips and local knowledge, he once again shows how what could be a very scientific subject could be distilled into a concise, informative and highly enjoyable read. The many different types and sources of opal worldwide are covered, but perhaps more importantly, the author manages to capture the elusive play of colour seen in opals in such a way as to make the images come to life on the page. Many of the images wouldn't seem out of place in books ten times the price, but their inclusion alone made his books an invaluable source for all, and at a price within reach of everyone.

Rubies & Sapphires, which saw four editions produced, includes corundum history and lore and the hunt for new sources. Fred provides a cornucopia of information, wrapped up in his unique story-telling style that keeps the reader engrossed until the last page. Even imitations and synthetics were dealt with in the same manner, and Fred manages to make these seem as equally desirable as their natural counterparts.

Many of the images wouldn't seem out of place in books ten times the price, but their inclusion alone made his books an invaluable source for all, and at a price within reach of everyone.



As would be expected, *Diamonds* makes an appearance in the series. This volume underwent several revisions, as befits this most sought after of gems. Again covering history, lore, science and commerce, Fred guides the reader through a minefield of facts and fiction, delivering in his own inimitable style the key facts that any gem collector should know. Many of the images show the most highly-prized diamonds, such as those in royal collections, but Fred was careful to balance this with true commercial aspects and industrial uses, thus giving a truly balanced overview.

Phenomenal Gems — Gems that do tricks differs from the rest of the series in that it does not focus on a single gemstone, but rather highlights the range of optical features seen within stones, looking at how gems interact and play with light. Although these effects may be mentioned briefly in the other books in the series, *Phenomenal Gems* delves into them in greater depth, with outstanding photography. What could be a very scientific area is actually dealt with effectively, without drowning the reader in science, but by carefully introducing the concepts in an engaging way.

The series wouldn't have been complete without a volume dedicated solely to the care of these magnificent stones and, as would be expected, Fred provides his usual style in covering how the gems feature throughout the series should be cared for, in order to maximize their beauty and lifespan.

When put together, this range of eight books proves to be more than the sum of its parts, providing a well-rounded and all-encompassing source for all gemmologists. The overwhelming feeling generated by this series is that Fred knew gems, and by a combination of his unique writing style and stunning images, he was able to clearly and concisely convey information to the reader. I always steer students or anyone expressing an interest in stones towards these books, as I found them to be an invaluable help when I was studying. Fred's books have been an integral part of so many gemmologists' training, and one can only hope that his books continue to provide a fitting memorial to his life's work and talent.

To view some of Fred's iconic images visit <http://wapo.st/2aV2fOC>. ■

The many facets of John Dyer

Gem-A talks to the renowned and much-admired lapidary John Dyer, one of the speakers at this year's Gem-A Conference, about the science and art of gem cutting.



John Dyer faceting at his work bench.

How did you get into cutting? Did you train as a cutter? Are you trained as a gemmologist or is everything you know from what you've picked up?

I loved gems and business from an early age. I was also home-schooled and one of my parents' strategies for teaching me was to purchase books on subjects I was interested in, so they bought books on gems and gemmology for me (*Gem Identification Made Easy* by Antoinette Matlins and Antonio C. Bonanno was one of the first) and that stoked my interest.

At 16 I wanted to start in the gem business and my dad said he would help me out. One thing led to another and we ended up going to Zambia to buy gemstones. We bought rough gems instead of cut ones to get a better deal and when we brought them back we took them to a cutter to have them cut. He did a really bad job on them and charged us a lot of money for it (in spite of the fact that we had gone to him and asked for help since we were just starting out and on a low budget!). This resulted in us getting mad and buying a faceting machine because, as my father said: "We can do that well, or better, ourselves, and cheaper too!"

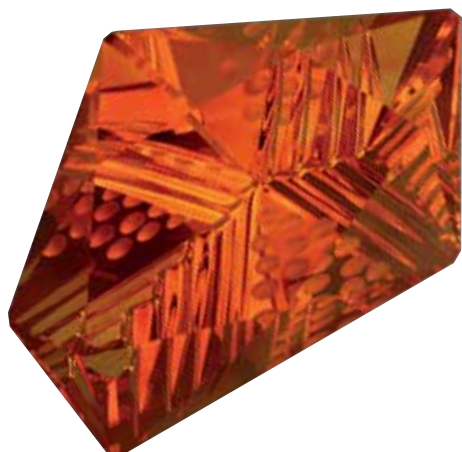
This all turned out to be a blessing in disguise because it helped us to discover

that I love to cut gems and that I have a certain God-given talent for it. So although the gems we bought on that trip were not super profitable in the end, it started us in the direction of what has now become the focus of our business — high quality and creative gem-cutting.

I never had any formal training. There were no lapidaries interested in teaching near me that I knew of, and as far as gemmology goes I mainly learned from books and practical experience. I would consider myself a far better cutter than gemmologist, but I do have certain practical, applicable gemmological techniques which help me when purchasing rough. Rough is almost easier to ID than cut gems, because you often still have the crystal habit, visible cleavage planes and more inclusions and other factors to help identify a gem and potential treatments it may have undergone.

Are there any lapidaries you greatly admire or who have influenced you?

There are a good number of creative lapidaries out there and I would say, to a certain extent, all the ones I know influenced me to some degree, but no particular one to the exclusion of the others.



A 28.03 ct Citrine Dreamscape™.
Photo by John Dyer.

Does the stone influence your design or do you choose the stone based on a particular cutting style that you want to see?

The shape, colour and clarity of the rough are the main considerations in choosing the cut I am going to do. Usually I buy the best rough I can find and then cut to what I feel is best suited to it. There are times when I don't buy a piece because I feel the shape and size it could cut would not have good marketable appeal, but other than that I pretty much let the rough dictate to me what it wants to be (that's within certain limitations of marketability and visual appeal, of course).

That challenge that each gem represents — trying to bring out its maximum potential — is one of the things I most enjoy about cutting. There are so many considerations that go into it and for the most part all those decisions are made on the fly as I saw and preform (pre-shape) the gem for dopping and faceting or carving.



*A 60.37 ct concave-faceted amethyst.
Photo by Lydia Dyer.*

How do you arrive at new designs?

They usually arise from the shape of an unusual piece of rough. Sometimes they come from patterns I see here or there (I am still trying to figure out how to employ the pattern in a wooden cutting board a client gave me).

The design might be an isolated concept in other cuts, that can be adapted in a new and different way to achieve something beautiful. Just the shape of a single facet can lead to new ideas. Also in this creative process I often ask for God's help since He is the most creative being of

all and I do feel that He gives me much of my inspiration.

What is your favourite stone to work with? Do you have a preferred design for it?

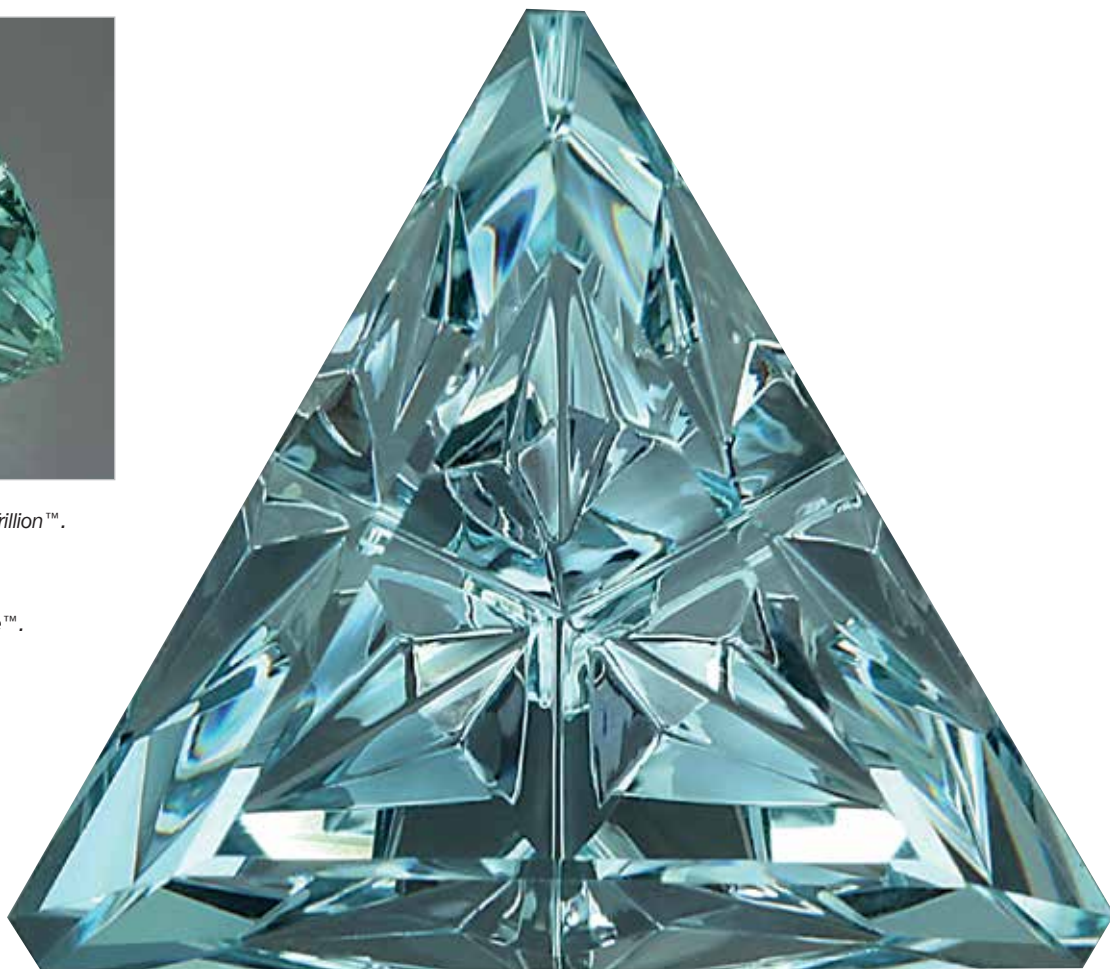
My favourite gem to work with is aquamarine since it comes in reasonably large and clean gems, is easy to polish and has great transparency so it is well suited to a wide variety of different cutting styles. Also, since it isn't dark, it shows the cut well instead of hiding it like some extra dark gems do.

There are sometimes cutting styles I prefer for specific gems; those with high dispersion (e.g. zircon) do better with flat faceted cuts than with concave facets or carving, since those tend to reduce the dispersion. On the other hand, I love carving and concave faceting for gems with lower dispersion since these techniques can increase the perceived brilliance in these materials. It's all part of the decision making process when deciding what to cut a specific piece or rough into.



*Above: A 46.81 ct Aquamarine Super Trillion™.
Photo by John Dyer.*

*Right: A 13.07 ct Aquamarine StarBrite™.
Photo by Lydia Dyer.*





Rare red beryl (bixbite), cut by John Dyer & Co.
Photo by Lydia Dyer.

You use many less well-known gemstones. Do you find that this increases the public's awareness of these stones, as you are highlighting how beautiful they can be?

As far as using 'less well-known' gems go I find that the market is much more accepting of a wide range of gems than in the past. TV shopping has introduced many strange gem types to a large public

...most of the gems I cut are still within the parameters of what is familiar to most jewellers — aquamarine, beryl, morganite, citrine, amethyst, ametrine, garnet of all kinds, sapphires, emerald, ruby, peridot, tourmaline (all colours), spinel and zircon make up most of my inventory.

audience and a certain percentage of that public has gone on to learn a lot about gems and become educated and sophisticated buyers. This, coupled with how expensive the 'traditional' gems have become, has really opened a wide door to the lesser known gems.

That being said though, most of the gems I cut are still within the parameters of what is familiar to most jewellers — aquamarine, beryl, morganite, citrine, amethyst, ametrine, garnet of all kinds, sapphires, emerald, ruby, peridot, tourmaline (all colours), spinel and zircon make up most of my inventory.

Sometimes I will do a very rare gem, such as bicolour spessartite, phenakite, oligoclase or similar, but they are the exception rather than the rule.

What do you endeavour to reveal in stones?

Essentially what I am looking to reveal is the full potential for beauty that is in each piece of rough. So much labour goes into the searching for and mining of gem rough that I feel it should be cut in a manner that respects its true rarity and uniqueness. But at the same time some sacrifices of size

and weight will need to be made for the gem to achieve its maximum beauty. That is the goal that I aim for.

What do you look for when selecting a piece of rough?

When selecting rough I look at the size, shape and clarity of each piece. I also take into account the value of the finished piece because there is a lot of labour involved in our cutting and if the finished value of the gem is too low we will not recoup our labour costs. For that reason there are some pieces of rough that are cool and pretty but I just can't buy them because they won't generate a profit.

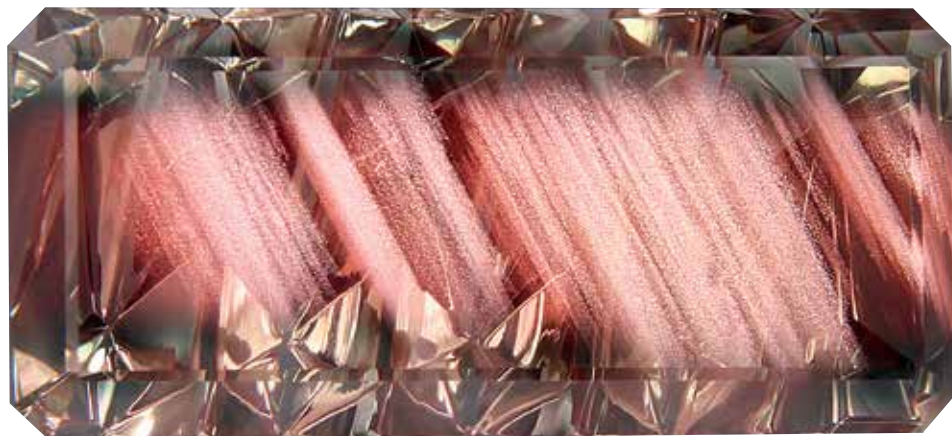
Do you travel to mines around the world to procure your own rough or do you often buy at shows?

I have travelled to various countries in search of gems. My most valuable gem (my wife) is Brazilian from the state of Paraíba so the search has paid off!

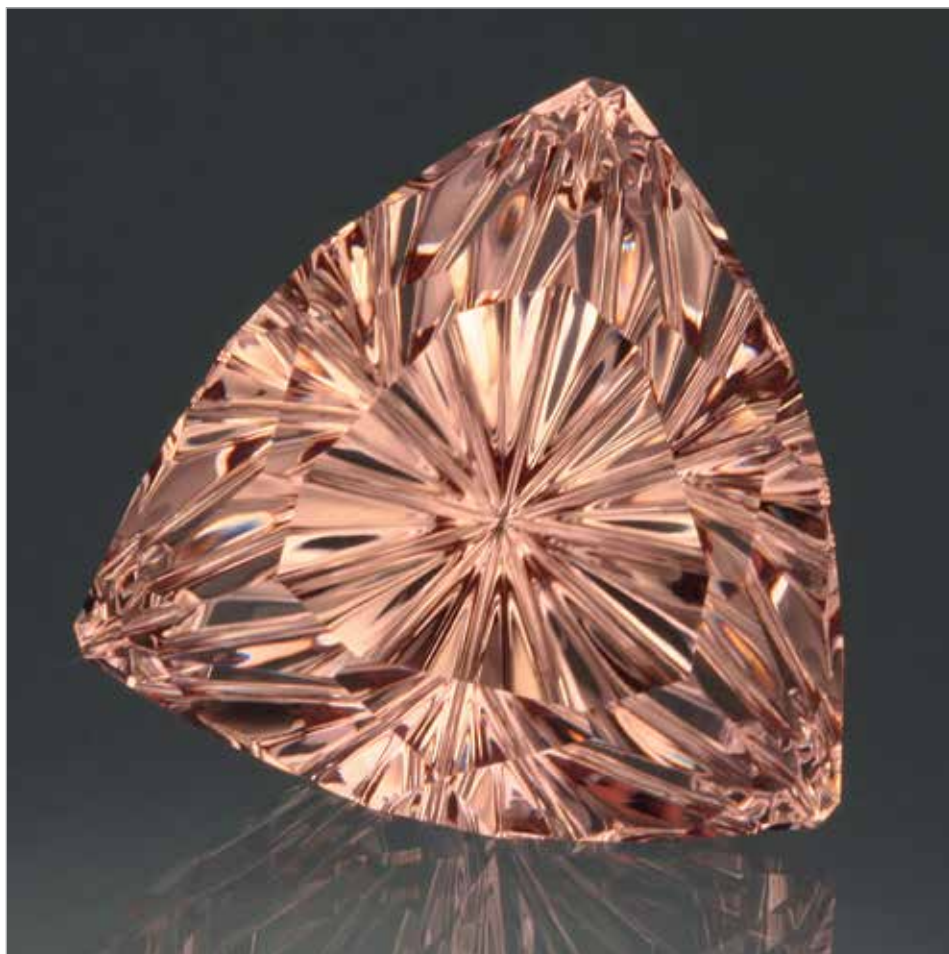
However, gems are often found in very small quantities and a trip direct to the mines can be a fruitless affair since there might not be any production for months at a time. This often results in my needing to buy from middlemen of some kind. Over the years we have formed relationships with a number of rough suppliers who bring us a variety of rough, that it would have been very hard to have access to on our own. After all, cutting is a time consuming business and if I spent all my time running about after rough I wouldn't get much cutting done.

Have you had any major cutting catastrophes?

Major cutting catastrophes are something you like to put out of your mind, but there have been a number of them over the years. There was the kilo of pink tourmaline rough we heated without grinding clean first and broke almost all of it. There was a bixbite (red beryl) from Utah that cost us thousands of that we hoped to get over a carat's worth of finished cut stone out of it, but it shattered due to internal stress and we ended up with three very small gems from it. There was the imperial topaz that I was carving and got too hot and broke it in half... and many other gems that have broken during carving, or been chipped or something similar. Over 20 plus years of cutting there are a lot of things like that which happen.



Untreated Oregon Sunstone 16.58 ct in a ZigZag™ cut by John Dyer & Co. Photo by Priscilla Dyer.



Above: Morganite StarBrite™ 50.92 ct cut by John Dyer & Co. Second place winner in the AGTA Cutting Edge Awards 2011, Combination Category. Photo by Lydia Dyer.

Top right: Bicolor Tourmaline StarBite™ 3.54 ct cut by John Dyer & Co. Photo by John Dyer.

Bottom right: 26.11 ct Citrine Super Trillion™ Photography by John Dyer

Talk us through the process of one of your famous cuts such as Super Trillion. What's the process of cutting a gem in this way? How long does it take to cut some of your most famous designs?

The Super Trillion™ is all flat faceted and is an adaptation of a cut that was explained to me by Chris Remen (now deceased) which over time I tweaked to make a number of improvements to. The result is a semi-traditional looking trillion which I feel is super. Since it has so many facets it is very time-consuming to cut. How long it takes depends completely on the type of material and the size of the gem but it usually takes a day or longer to complete.

Do you have any advice for people who want to take up lapidary?

To take up lapidary as a hobby, the best thing to do is search for a local lapidary club. Often there will be retired members

who will teach cutting for a very reasonable price and this often allows you to avoid the initial relatively high cost of the machinery and supplies. For those who want to make this a profession, I would recommend studying the market to make sure that it is really what they want to do... because it is not the easiest thing to make money at.

You need to be a skilled cutter (something that often takes five years or more to accomplish) but making a living at it also requires large investments in gem material if you are going to sell your own gems. If you don't sell your own gems, you are going to need to find a niche market and be very fast if you expect to make money because much of the gem trade is used to Asian pricing on gem cutting and that is hard to compete against...

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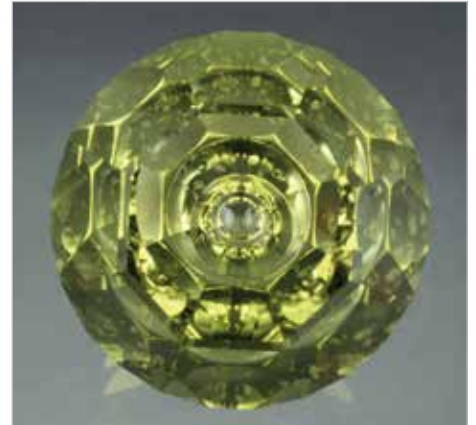
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John Dyer's flame-cut citrine, first place winner in the 2015 German Award for Jewellery and Precious Stones in Idar-Oberstein. Photo by Lichtblick Foto-Design, Hiltrud & Jurgen Cullmann of Schwollen, Germany.

You've won many awards for your work; which means the most to you? Which one was hardest to achieve?

The award that means the most to me is the first place I took recently at the German Award for Jewellery and Precious Stones Idar-Oberstein 2015. This is one of my favourite competitions, but the fact that you have to adhere to a theme makes it more complicated. You might have a perfectly beautiful idea for a gemstone cut, but it must go with the theme to win. The theme in 2015 was 'Light My Fire', so I thought that an orange gem would fit well with the idea of fire. With this in mind, I searched through my stock of rough and selected a deep orange citrine, which, once ground clean, was a flame shape. Despite this it was still a challenge to decide what to do with the underside of the gem to make it look like fire. However, an idea came to me to execute a pattern that I had never done or seen before and which required an adaptation of my existing machinery and techniques — the result is a gem with a flame shape, but which also has little flame-shaped internal facets on the back which reflect light individually with varying intensities so that they look like flames shooting upwards as the gem is moved.



Lime Citrine Reflections™ 34.35 ct by John Dyer & Co. Third place winner in the 40th German Award for Jewellery and Precious Stones, Idar-Oberstein 2009. Photo by Lydia Dyer.

Where do you see yourself going with your talent? What's next for you in the lapidary world?

It might not be super romantic, but I guess what I see is gradually improving what I already do and adding new styles and techniques to that. As a result of this I feel that each year our gems are better cut, more beautiful and more saleable. ■

To view more of John Dyer's work visit www.johndyergems.com

Booking is now open for the Gem-A Conference 2016, to be held from 5–6 November at the Royal Institute of British Architects, where you can hear John discuss 'The science and art of gem cutting' in his talk. To book your place visit: <https://www.eventbrite.com/e/gem-a-conference-2016-tickets-25865073130>.

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Diamonds: Gem Set and Match

Jack Ogden FGA ponders the history of diamonds in engagement rings.



2: Man presenting his significant other with a ring, 1514.

A casual drift around the internet or a glance through the glossies might give you the idea that De Beers somehow invented the diamond engagement ring back in the mid-1900s, or, if they didn't invent it, then they put their marketing muscle behind an existing but not common practice. The truth is that the sentence above appeared in the book *Manners and Social Usages* written by Mary Elizabeth Wilson Sherwood, published in New York in the 1880s. There are plenty of other references to diamond engagement rings in that era. A few years before that book was written we are told that a solitaire was the typical engagement ring in the USA — in Britain a diamond-set gypsy ring was favoured. For men too poor to afford a diamond ring, a broad gold band was recommended. Shown in **1** is a drawing of a diamond solitaire ring from an 1870s US Patent — the new idea in the patent was platinum-tipped prongs.

How far back we can trace the use of diamond engagement rings really depends on what we mean by 'engagement ring'. The first use of the term 'engagement ring' I have found so far dates from 1812, so to look back before that we need to consider diamond wedding rings and diamond betrothal rings.

As this is a gemmological publication we can start by noting that in 1652 an early English writer on gemstones, Thomas Nichols, wrote rather charmingly that the hardness of diamond meant that it could "be used symbolically as a signification of constancy" — that is 300 years before De Beers first said that a diamond was "forever". The 1600s provide several examples. A diamond ring plays a part in the 1613 short story *The Two Damsels* by Miguel de Cervantes — best known for *Don Quixote*. The ring is described as being engraved with the words 'Marco Antonio is the husband of Theodosia'. A few years later another well-known author, Molière (real name Jean-Baptiste Poquelin) wrote a play called *The Forced Marriage* in which a man seeks to buy a diamond ring for his intended spouse. Even Samuel Pepys referred to a wedding ring set with diamonds in 1668. The image in **2** of a man presenting his intended with a ring dates from 1514. Unfortunately it is not clear what type of ring it is, but it may well have been intended to be diamond — they were so used back then.

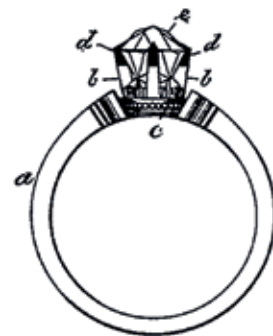
Here is a question for you. Read this sentence about engagement rings: "As for the engagement ring, modern fashion prescribes a diamond solitaire, which may range in price from two hundred and fifty to two thousand dollars." When do you estimate that was written? Before or after World War II?

A frequent contender for the first diamond betrothal ring is a ring with the bezel in the form of an 'M' now in the Kunsthistorisches Museum, Vienna. This is often said to be Mary of Burgundy's betrothal ring — she married Maximilian I of Austria in 1477. It is a photogenic ring, but there is no evidence that it was really her betrothal ring, but we do know that a diamond ring played a part in the nuptials. As a young girl, we are told, Mary was ordered by her father to send a diamond ring to Maximilian's father as a promise that she would marry him. An engagement ring of sorts I suppose, but it was sent to the father of the groom. Besides, an arranged marriage of a child bride is perhaps not a connotation with which the modern diamond industry would wish to associate.

There are other examples of diamond rings associated with marriage in Italy in the 1400s, for example, at the marriage of Constanzo Sforza and Camilla D'Aragona in 1475. In the British Museum there is an Italian gold ring set with a diamond with the inscription *Lorenzo a Lena Lena* — presumably meaning that Lorenzo gave it to his love Lena Lena. But we can't let Italy take all the glory for early diamond set wedding or betrothal rings. In 1417 in England a woman called Johanna Fastolf died. Her Will mentions a diamond-set ring engraved *Vous aime de tout moun coer* ('[I] love you with all my heart'). It is tempting to assume that this must have been her wedding ring.

With other medieval diamond rings and those from the Roman period, there is no way to establish whether they were connected with marriage. We know it was the practice for the Roman man to give his intended a ring, and sometimes the other way round too. Many such rings survive, some identifiable by their design, others by inscriptions. The Roman writer Ovid mentioned a man sending a ring to his beloved with some rather unsubtle (and unprintable here) double meaning. We don't have a picture of Ovid, but when the *Nuremberg Chronicle* was printed in 1493 it had a little image of Ovid holding a ring — probably in reference to this (**3**). With the coming of Christianity it all got a bit more formalized, but rings still played a part — if you could afford them. In the 300s Augustine of Hippo (a place in what is now Algeria, not the animal), later known as Saint Augustine, explained that a priest shouldn't hesitate to marry a couple even if they were too poor to give rings to each other.

A millennium and a half after Saint Augustine, a French author similarly noted that it was surprising how many marriages were prevented for want of a diamond ring. Here however, the intention was more cynical — a reminder that it was not unknown for a man's wealth to be a factor in attraction. History provides us with some useful gem marketing material, but also teaches us is that in some things little has changed. ■



1: Drawing of a diamond solitaire ring from an 1870s US Patent.



3: Ovid holding a ring, from the Nuremberg Chronicle.

Crossword puzzle solved

Here are the answers to last month's gemmological crossword which originally featured in *The Gemmologist*, Vol. IV, No. 43, Feb. 1935.

1	T	O	U	R	M	A	L	I	N	E	F	G	A
12	O	P	T	I	C	A	L	V	A	M	P	E	D
15	P	A	T	T	A	R	D	I	C	E	B	O	X
20	A	L	E	O	N	O	V	E	R	R	U	L	E
23	Z	I	R	C	O	N	E	D	E	A	C	O	N
27	R	O	N	D	E	L	S	I	L	K	G	O	
32	B	L	O	O	M	Y	S	U	N	D	R	Y	N
36	R	I	N	D	I	G	O	N	S	C	O	P	E
41	A	T	S	D	E	A	N	S	P	H	E	N	E
44	D	E	E	M	R	R	I	T	E	E	C	H	O
50	I	A	N	I	S	N	T	O	C	E	L	O	T
54	U	N	S	C	R	E	E	N	T	R	A	M	O
	M	M	E	E	T	T	P	E	R	I	D	O	T

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