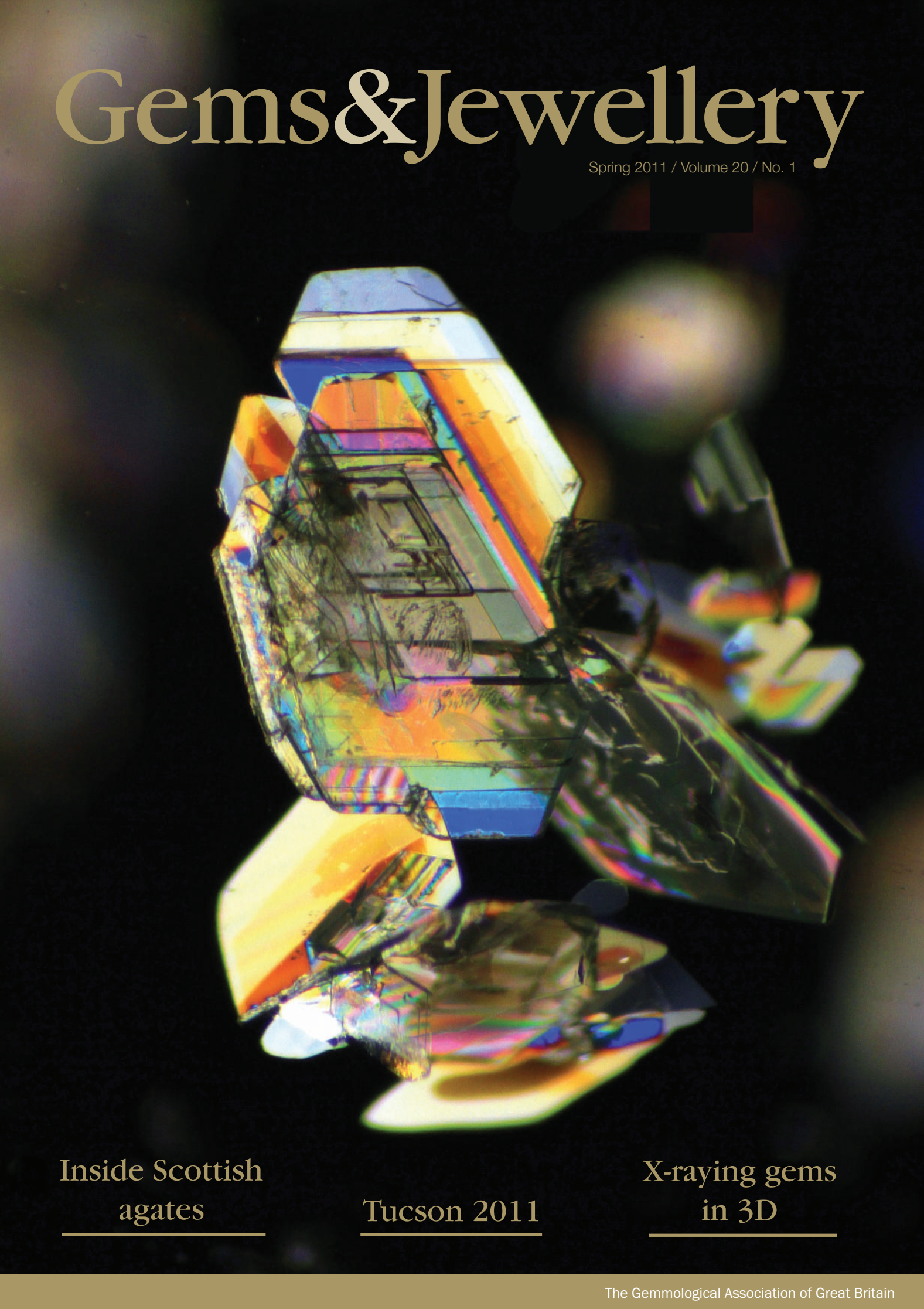
Gems&Jewellery

Spring 2011 / Volume 20 / No. 1

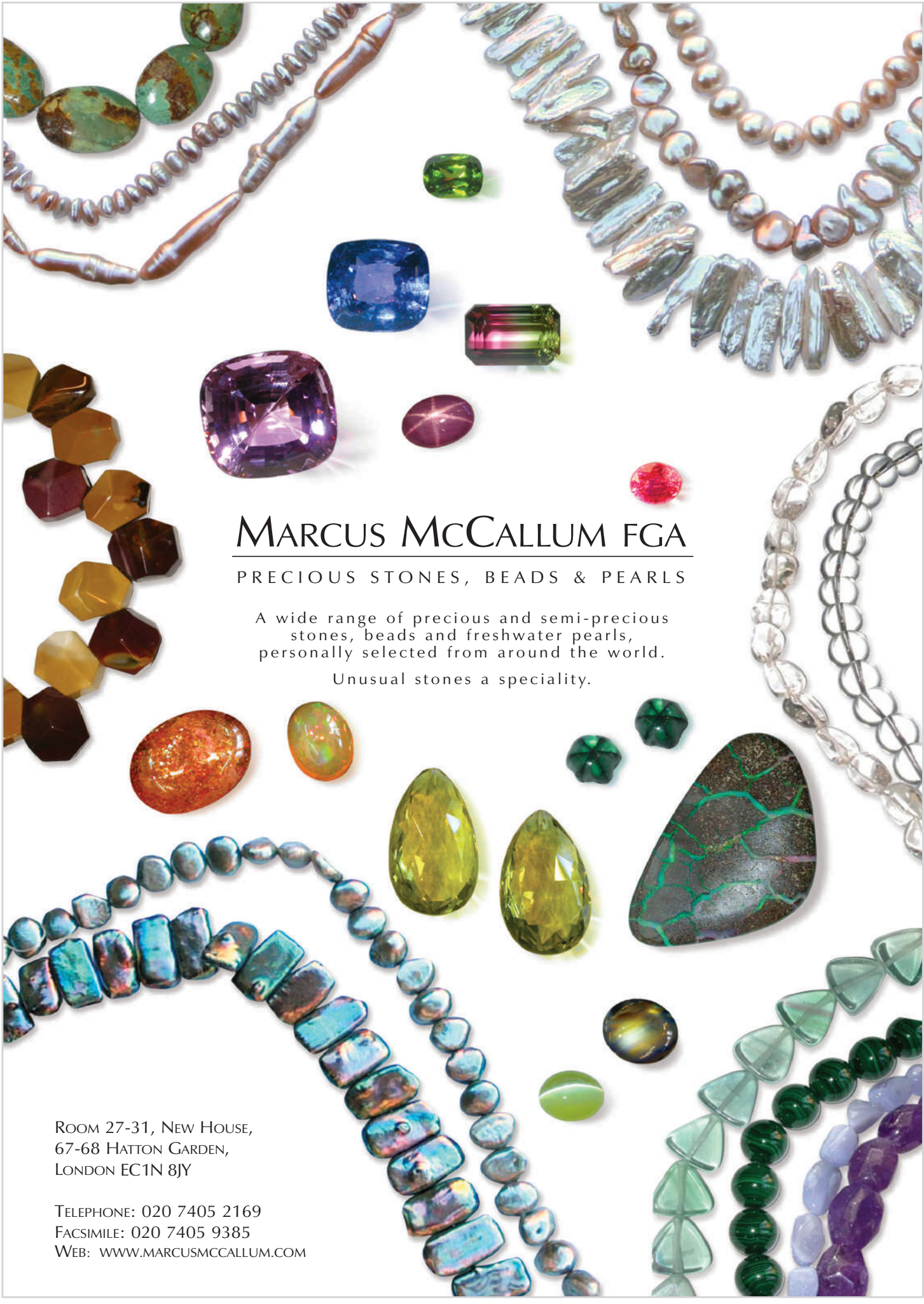


Inside Scottish agates

Tucson 2011

X-raying gems in 3D

The Gemmological Association of Great Britain



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Editorial

Gems&Jewellery
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Contents

An accessible past

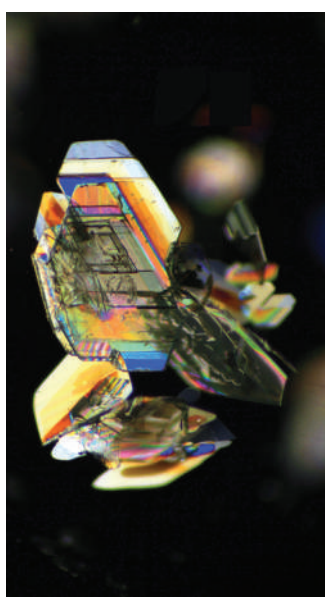
One of our ambitions this year at Gem-A is to start to get back issues of *The Journal of Gemmology* scanned and available on the internet so that they can be read and searched. The least costly way to scan is to start with a complete set of unbound issues. Naturally, most of the early *Journals* we have are bound, but we are currently sorting through the others and hope to make up a full unbound set soon.

Looking through old issues of *The Journal* since 1948 is a journey through gemmological history. Announcements of new gem discoveries, new scares and new equipment jostle with history and myth; obituaries of legends rub shoulders with the gentle humour of Alec Farn's always informative 'Notes from the Laboratory'. So much has changed, but in terms of enthusiasm, apprehensions and the keenness to advance scholarship, much remains constant.

Perhaps the most noticeable change over the years has been in its printing — particularly that of the photographs — with the improvement in their print quality and, of course, the move from black and white to colour. Today it may seem almost unbelievable that, for example, the large number of photographs in Dr Edward Gübelin's series of articles in the 1940s and 1950s on the internal world of gemstones were printed almost entirely in black and white. Compare that with some of the recent spectacular inclusion photos that have appeared in our publications by contributors such as John Koivula, Michael Hügi and, in this issue, Tony de Goutière (see page 34), as well as Brian Jackson's superb agate photos (page 3). We can't be sure what developments in photography, photographic reproduction and academic publishing there will be over the next generation, but they will almost certainly be interrelated, and web pages and their image content will continue to develop way beyond being simple screen analogues of book or magazine pages. This is already being seen in online courses, but it will be exciting to see how it will affect academic publications.

There is little doubt that having past, present and future issues of our *Journal* available on the internet will widen awareness of Gem-A as well as access to our publications — a worthy ambition for the future and a due acknowledgement of our past.

Jack Ogden
Chief Executive Officer



Cover Picture
Muscovite inclusions in aquamarine by Tony de Goutière. Transmitted polarized illumination. See Unusual Inclusions, pages 32–35.

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Scottish agates

Brian Jackson explores the theories of agate genesis, the unknown mechanism by which agates produce their extraordinary banding and colour structures.

1: Banded agate, 'Blue Hole', near Usan, Montrose, Angus.

Agates are one of nature's more exquisite combinations of colour and structure, ranging from the bold and brash to the delicate and fine. Due to their relative abundance, they are often damned by the gem trade as 'semi-precious', and fare no better in geological circles where they are still largely a victim of scientific disinterest. Despite these dismissive views agates still have the presence to enthrall the viewers and challenge scientists.

Agates are probably the most common gemstones on earth. They have been used by humans for ornamentation for perhaps 7000 years, although several ancient agate artefacts dating back as far as 9000 years have been recovered in Mongolia. Agates have also been recorded on every continent and in several different geological environments. All the images shown in this article are of agates formed in gas cavities in Scottish lavas.

For all its beauty, agate is a chemically simple substance, consisting mainly of silicon dioxide (SiO_2). Within agates a number of different SiO_2 phases and structural varieties have been identified. These are quartz, moganite, opal, chalcedony, microcrystalline quartz, quartzine and granular quartz.

The challenges come from the interpretation of agate; from finding a mechanism that can account for the variety of colours and generate such complex banded structures. Professor Peter Heaney (the then associate Professor of Geosciences in the College of Earth and Mineral Sciences, PA, USA), said of agate, "Even in mineralogical terms, this is complicated stuff — or it would have been solved a long time ago." Were it not so, agates would have been produced synthetically under laboratory conditions, yet to date no one has ever made an agate (although synthetic chalcedony has been produced (White *et al.*, 1961)). The inability to produce synthetic agate has resulted in the proposal of numerous models to explain the banded structure, but after 150 years of addressing this problem the genesis of agate remains enigmatic.

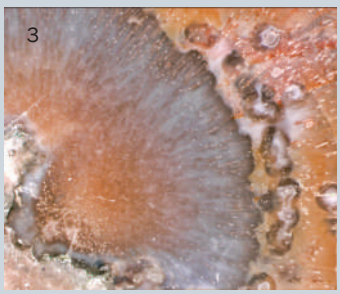
Natural processes, often elegant in their simplicity, can result in stunningly beautiful outcomes. The natural abundance of chalcedony in differing geological environments demands an explanation; one that is both unconstrained by this diversity and describes more or less the same growth development process. Therein lay the seeds of the enigma that is agate genesis.

In addressing the problem of agate genesis a unifying theory is necessary to account for all the differences and to answer the agate formation questions. The structures seen in agates have long been the inspiration for developing early agate genesis theory. More recently sophisticated analytical equipment has been used and this has advanced understanding greatly without actually solving the problem.

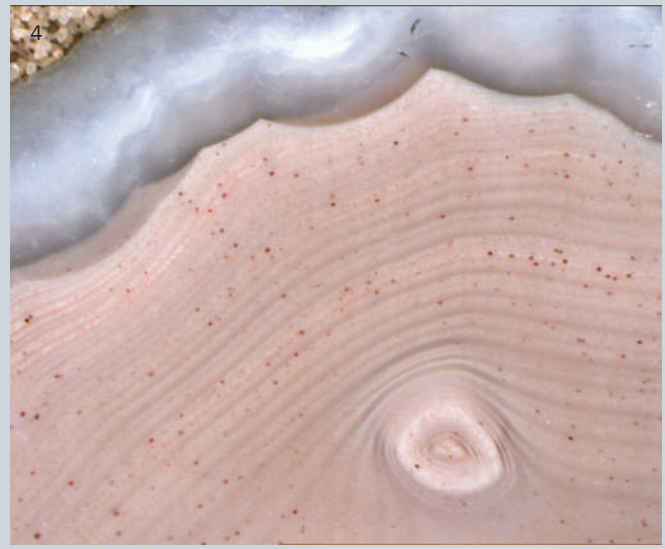
The images displayed on the following pages illustrate the nature of the problems that need to be overcome if we are to finally resolve the question of how agates form.

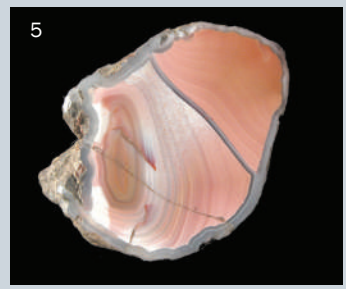
Gems and Minerals

Scottish agates (cont.)

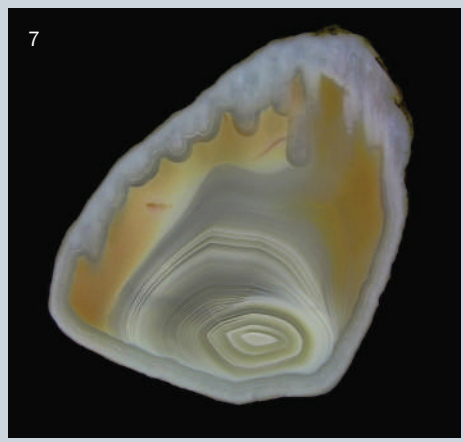


2 and 3: Needle-like crystals of zeolites are sometimes the first minerals to crystallize in the gas cavities. Their presence influences the later agate structure and impacts on the theory of structural bands.





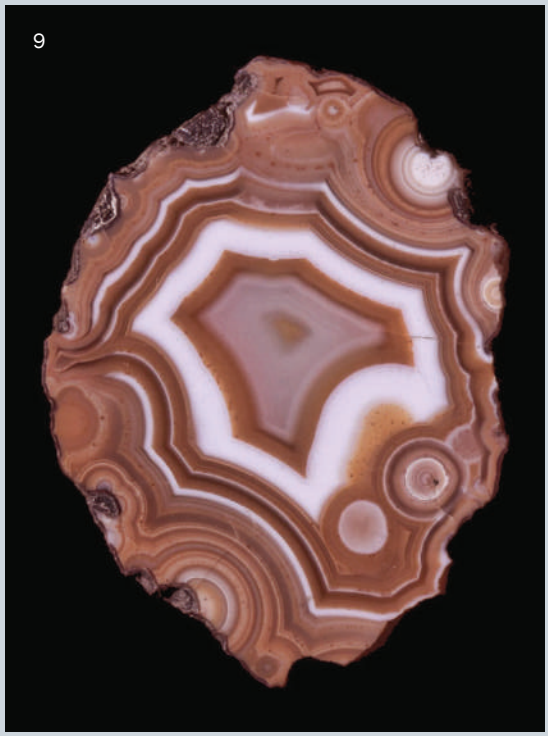
4 and 5: The next feature seen in all amygdaloidal agates is the clear chalcedony layer around the margin. This has diffusion and osmosis implications for silica-bearing solutions entering the gas cavity.



6 and 7: The clear chalcedony layer can be influenced by existing structures or gravity-produced stalactitic structures.
8: The clear chalcedony layer has wrapped around existing features to produce stalactitic structures. The agate has been cut such that the stalactites appear as circles. These subsequently impact on the banding structure.

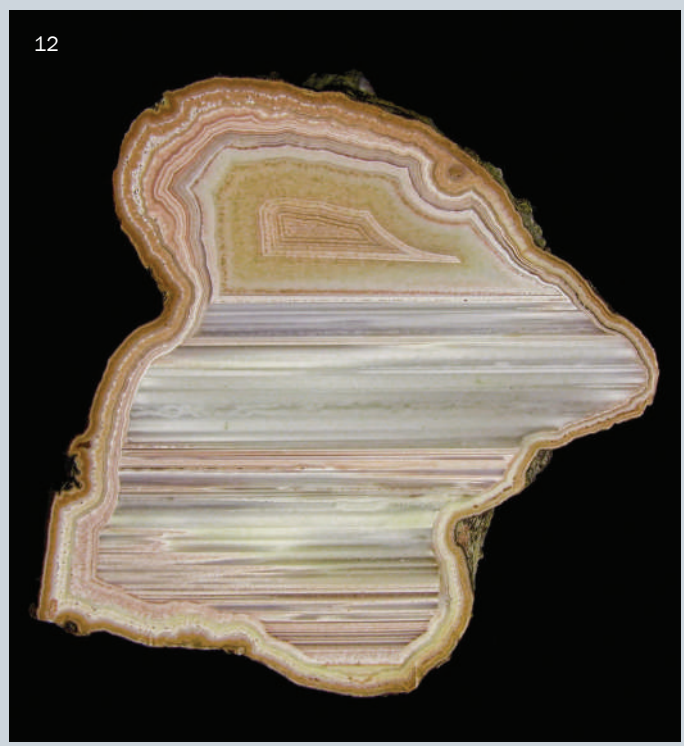
Gems and Minerals

Scottish agates (cont.)



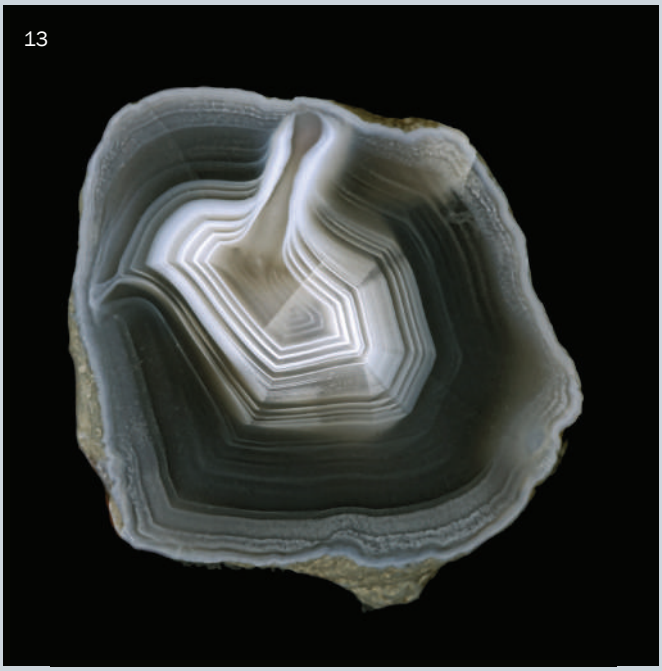
9 and 10: A feature associated with growth on the clear chalcedony layer is the development of zoned hemispherical structures which, if cut across the dome, show circular eye-like structures.

11 and 12: When it comes to structural banding there are two basic types: (a) wall, or fortification banding (11), is that which conforms to the basic outline of the gas cavity, and (b) onyx banding (12) which is straight and parallel and controlled by gravity. It is the control mechanism wall banding that is central to the controversy surrounding agate genesis.



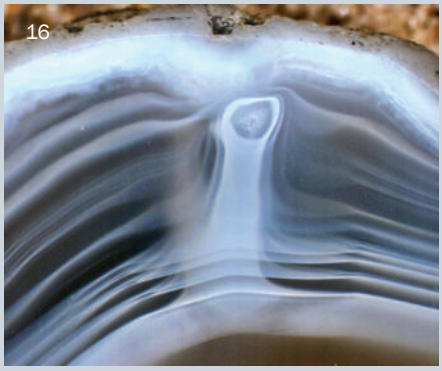
Gems and Minerals

Scottish agates (cont.)

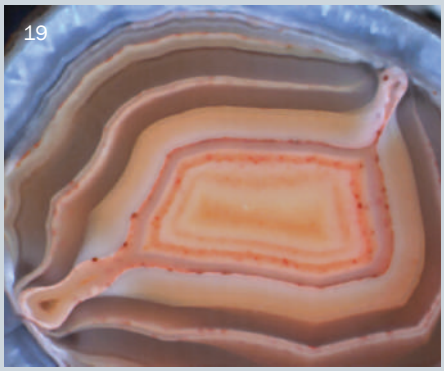


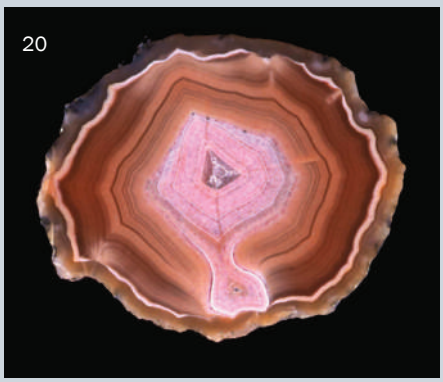
13 and 14: Agate showing 'tubes of escape.' A fundamental aspect related to wall banding is the so-called 'tube of escape'. The debate is whether this is a channel for solution entry or exit. There are many technical pros and cons, but what is central to explaining these 'tubes' is the thinning of the bands as they approach the outer rim of the agate. The inference is that something is preventing deposition, otherwise the bands would be of uniform thickness. There are two explanations for this: either the force of solutions entering the cavity is strong enough to attenuate deposition, or the force out of the agate cavity is. The latter may also infer plastic deformation — a tenet of one of the major agate formation theories.

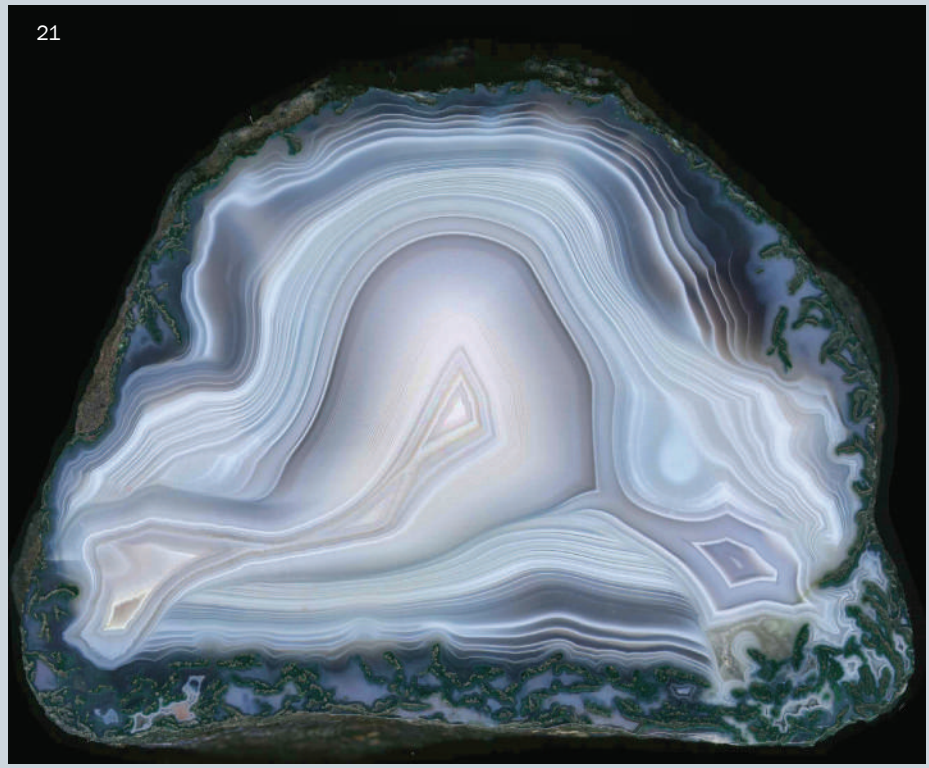
15, 16, 17, 18, 19, 20 and 21: Some 'tubes of escape' give credence to a jet-like infill aperture where there is but a tiny rent in the clear chalcedony layer.



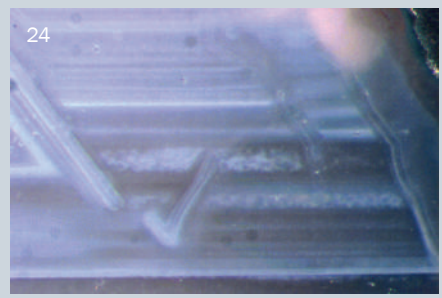
Scottish agates (cont.)







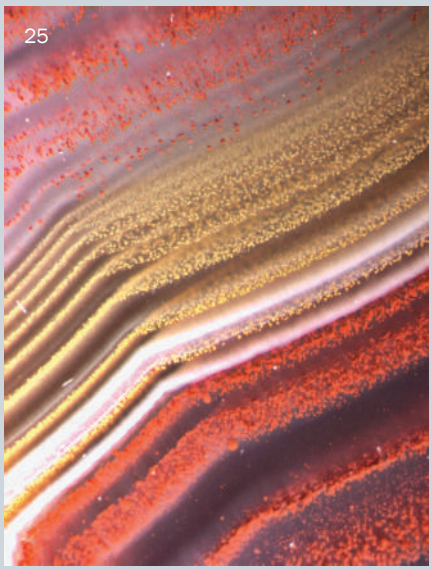
19, 20 and 21: Other 'tubes of escape' are less revealing about their origin.

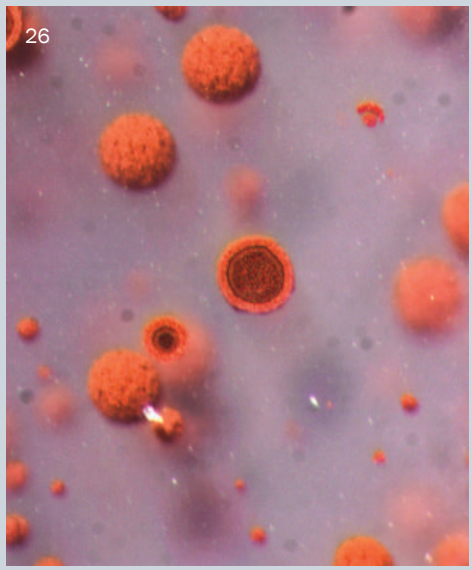


22, 23 and 24: Unless the structural bands were still gel-like when formed it is unlikely that they could subsequently be plastically deformed by later solutions entering the cavity. Ruptured banding is shown in 22 whilst 23 shows plastically deformed faulting and ruptured banding and 24 shows detached banding. This infers some dynamic activity within the nascent agate.

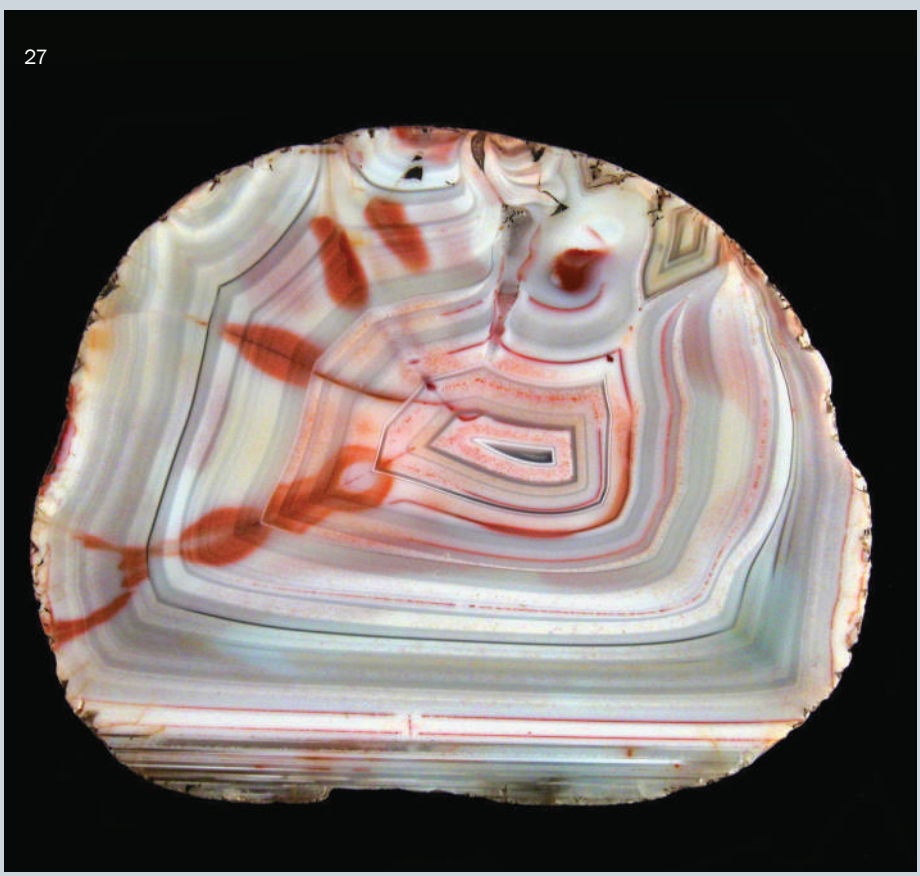
Gems and Minerals

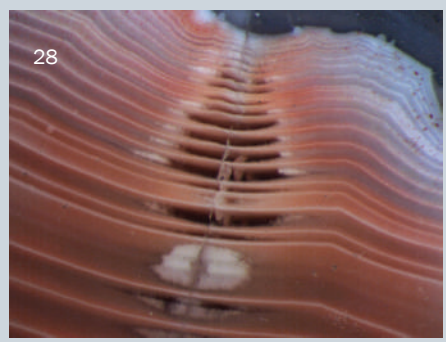
Scottish agates (cont.)





25 and 26: Independent of structural bands are colour bands; indeed, many structural bands can be subsumed within a single colour band. Iron oxides and oxy-hydroxides are responsible for the rich red, yellow, brown and orange colours found in agates. The red and yellow bands (25) are coloured by iron oxide (hematite) and iron hydroxide (goethite) respectively. They arise from minute particles of these compounds that have segregated within a silica gel prior to transformation into chalcedony. The particulates show concentric zoning (magnified in 26).

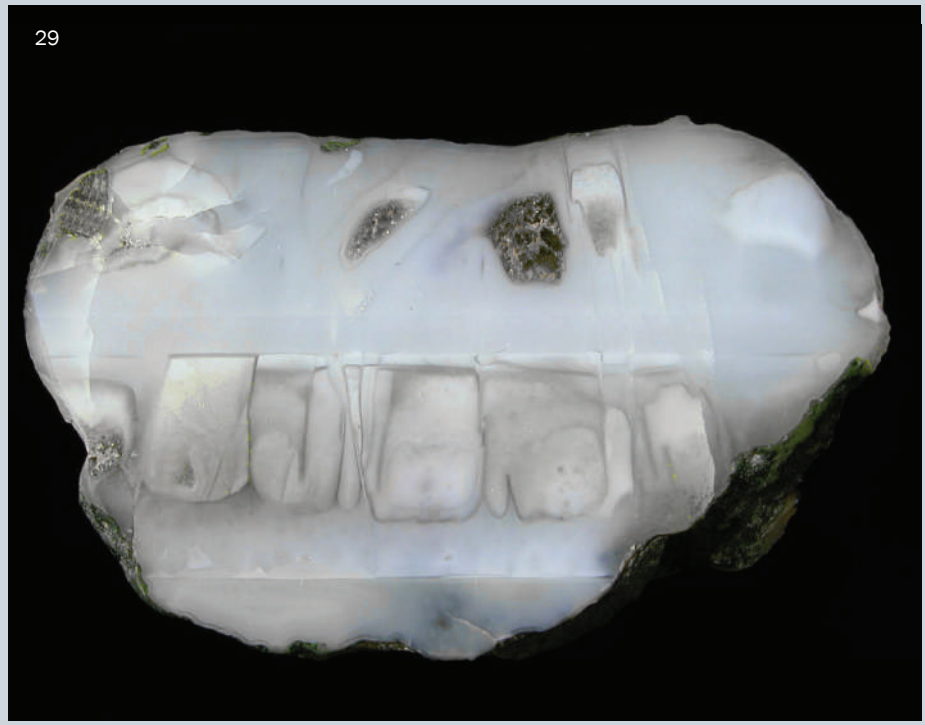


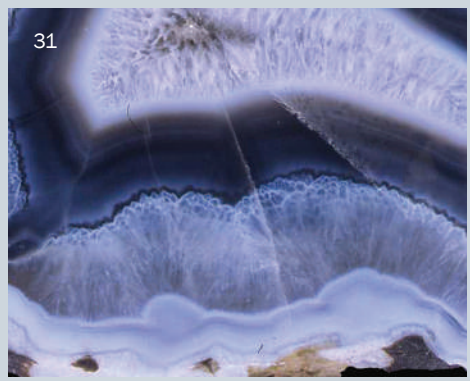


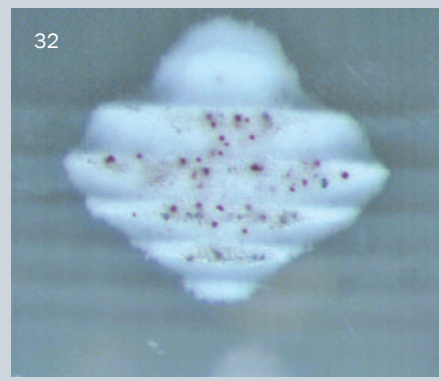
27: Colour can also be introduced when iron-rich solutions are drawn into the agate through microfractures and diffuse into the porous fibrous chalcedony.
28: These micro-fractures can also act as channels for dissolving silica.

Scottish agates (cont.)

These last four images could prove helpful in formulating a mechanism for agate genesis.
29: The thick layered onyx structure has smoky quartz segregations within chalcedony, suggesting an inhomogeneous mixing within a gel whilst the central onyx band has what looks like dessication structures that form brick-like units.
30: The tube-like structures appear to have micro-filament centres.
31: This agate from the Tertiary lavas of Skye shows a quartz band with distinct crystal terminations.
32: Perhaps the most puzzling image of all, where a softer cloudy white opal structure with a surface coating of red (possibly hematite) spots is cut by wall banded structural units.







Further reading

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About the Author

Brian Jackson FGA DGA

Brian has had a lifetime interest in agates and collected from most of the localities described in books on Scottish agates. As the Principal Research Curator at National Museums Scotland, Brian has had the privilege of curating the extensive collection of Scottish agates at the National Museums Scotland, and through his handling and study of agates has developed a fascination with the enigma of agate genesis.

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Three-dimensional X-ray radiography

Thomas Hainschwang FGA discusses a new imaging tool for pearl and gemstone testing.

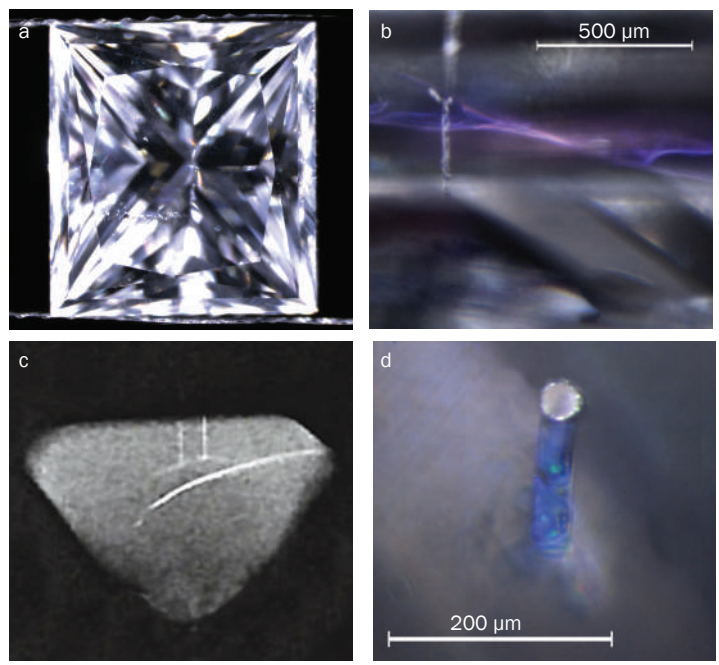
The latest problems in pearl identification have led to the introduction of a new analytical technique in the gemmological field: micro X-ray tomography as a method to visualize the structure of pearls in three dimensions, with higher contrast and resolution than is possible by conventional radiography (Karampelas *et al*., 2010, and Krzemnicki *et al*., 2010). While the method shows great results when performed with the best instruments available on the market, the drawbacks were also quickly revealed, such as required analysis time, cost of the equipment and cost of the analysis. These issues make tomography hardly suitable as a day-by-day routine method for gemmological laboratories, and have led to research into an alternative method for the imaging of pearls and gemstones. I have investigated the potential for modifying conventional radiography in order to use it as a three-dimensional X-ray imaging system, and consequently have designed and built the prototype of a three-dimensional radiography system.

The problems

In the past years the gem market has been flooded with fissure-filled gems — especially rubies — as well as hard-to-identify cultured pearls. The issues of properly separating cultured from natural pearls and of identifying all fissure-filled gems — plus quantifying the filler — have demanded more advanced analysis than standard radiography. A three-dimensional method for the visualization of the filler substances and the structure of pearls was necessary.

The fissure and cavity filling of gemstones with glassy substances has been known since the 1980s, when glass-filled diamonds were first marketed (**1**). Today its main use is for the lead glass treatment of corundum: this treatment is able to transform certain abrasive-quality corundum into attractive gems. Due to the extremely low prices of rubies treated this way, such stones are frequently misused for fraud and offered as unheated Mogok material.

While usually easily identified by microscopy, sometimes chemistry and radiography are necessary for proper identification, and quantification requires a three-dimensional image of the filled fissures and cavities.

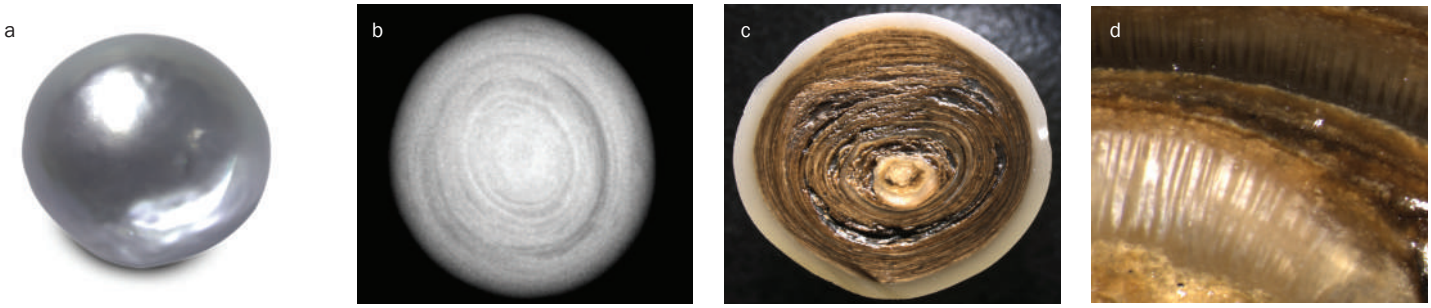


1: A fissure-filled and laser drilled diamond (a) with a strong flash effect in a large fissure which is connected to two laser drill holes (b). The radiograph (c) shows that two large interconnected fissures are filled and that the two laser drill holes are filled as well. The filling of the laser drill holes was apparent as a blue flash within the laser drill hole (d). Photos and radiograph by T. Hainschwang.

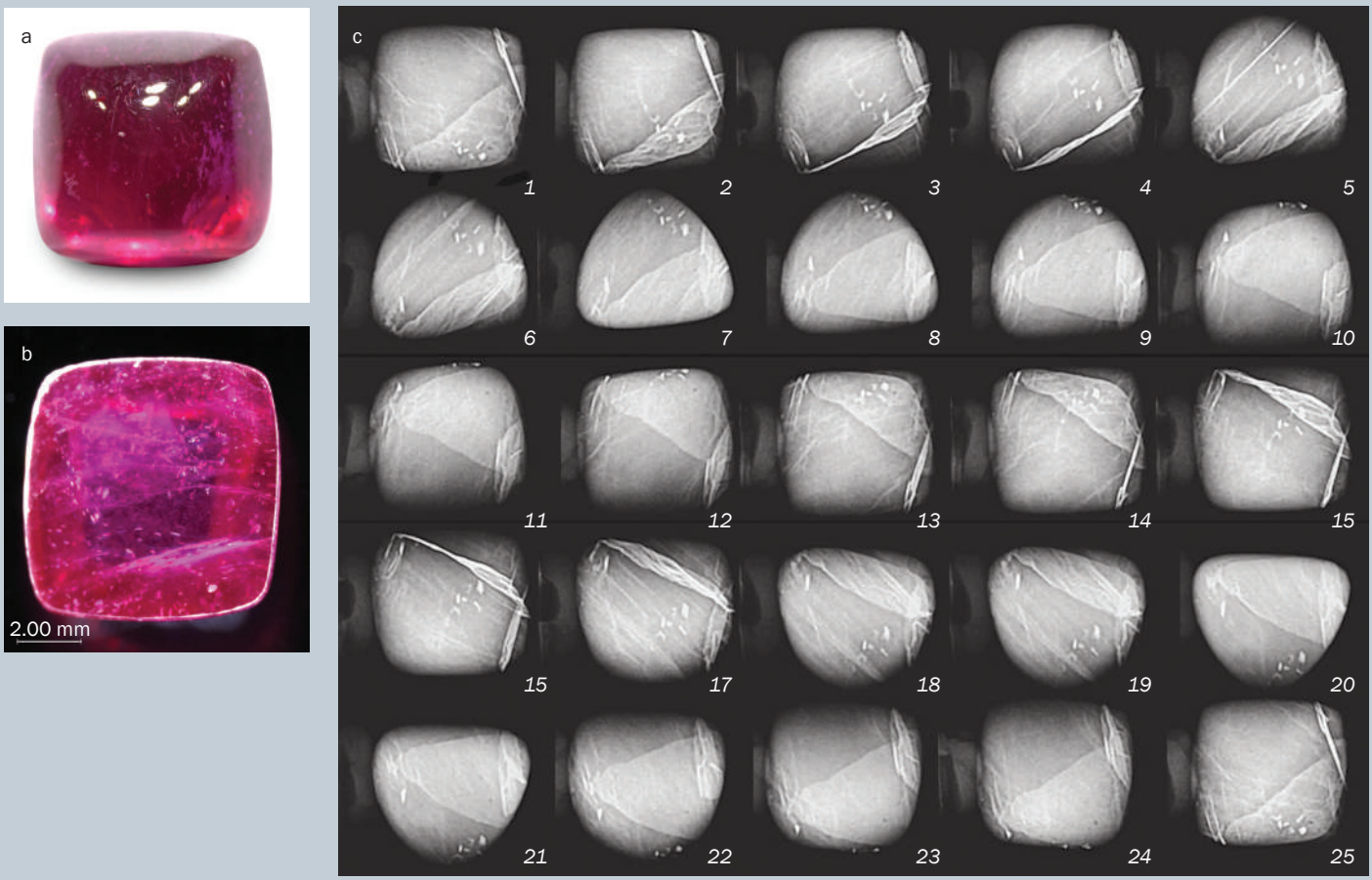
The pearl market has been challenged by several issues recently; it has become a disturbing tendency that beadless and beaded cultured pearls are pre-tested by radiography before sending the 'difficult' ones to a laboratory with the goal to pass them as natural pearls; quantities of such pearls have made the tour around the world through practically all pearl labs. On top of the beadless cultured pearl problem, the unscrupulous practice of culturing pearls using all types of pearls as beads, especially low value natural pearls, has

Gems and Minerals

Three-dimensional X-ray radiography (cont.)

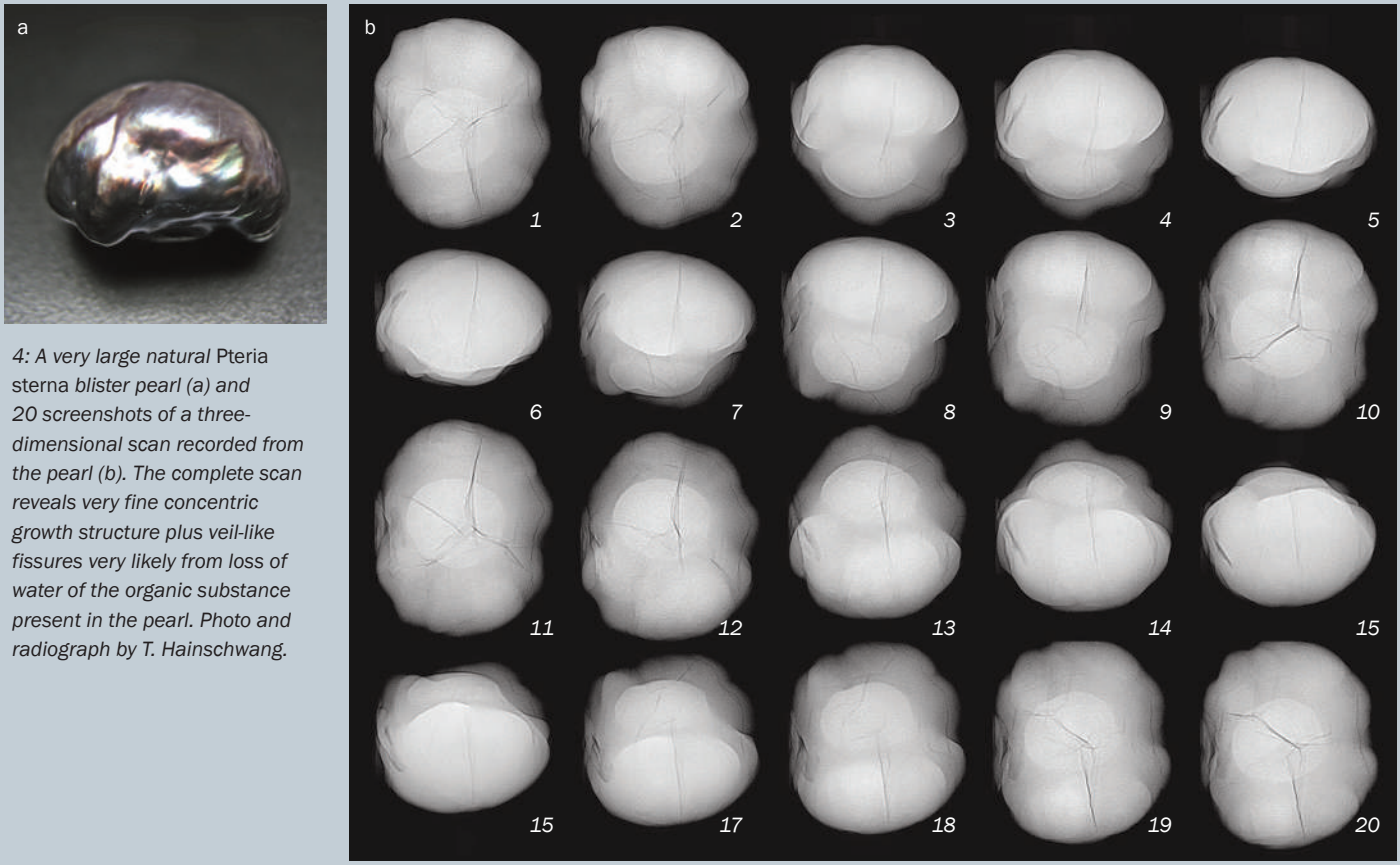


2: (a) A bluish-grey cultured pearl. A radiograph (b) was not sufficient to reach a conclusion on this pearl. The pearl was cut in half to reveal the brown non-nacreous natural pearl used as the bead (c and d). Photos and radiograph by T. Hainschwang.



3: The scans show a lead glass-treated ruby (a) with some glass in its fissures and voids. The inclusion scenario shown in (b) does not help interpretation unless you know the appearance of the glassy residues. A selection of 25 screenshots of a three-dimensional X-ray movie is shown in (c), and from these images the distribution of filled fissures is obvious. In contrast to many lead glass-treated rubies, in this stone the glass is only a minor component and therefore the stone should be declared as lead glass-treated ruby instead of 'lead glass-ruby composite gemstone'. The complete three-dimensional scan consists of many more images, but in order to permit good visualization via screenshots only 25 images were selected. Photos and radiograph by T. Hainschwang.

Three-dimensional X-ray radiography (cont.)



4: A very large natural Pteria sterna *blister pearl (a) and 20 screenshots of a three-dimensional scan recorded from the pearl (b). The complete scan reveals very fine concentric growth structure plus veil-like fissures very likely from loss of water of the organic substance present in the pearl. Photo and radiograph by T. Hainschwang.*

been discovered (**2**). As is usual with such unethical methods these pearls were never declared as cultured, but parcels of them were submitted to various laboratories in order to pass them as natural.

As a consequence of these pearl issues, as well as more and more ambiguities in pearl analysis, it was decided that simple radiography was not sufficient to reach conclusions on all cultured pearls. While several laboratories launched research using micro-X-ray tomography, I started research into an alternative technique which would enable routine three-dimensional structural imaging.

Three-dimensional X-ray versus micro X-ray tomography

The most sophisticated approach for three-dimensional X-ray imaging is micro X-ray tomography (see Karampelas *et al., 2010,* and Krzemnicki *et al*., 2010). The best instruments in the market allow very detailed high-resolution and contrast three-dimensional modelling of the structure of a pearl or gemstone. The disadvantages of this technique are that good machines on the market are very costly and that the acquisition of good data requires long analysis time; poorer quality imaging can be realized with shorter analysis time, but then the machine loses many of its true advantages.

With this in mind I thought of a more economical and rapid analysis method that would do much of what micro X-ray tomography can do, and after some research the idea of designing and building a digital radiography system with capacities for three-dimensional X-ray radiography was born.

A combination of a very high quality tunable X-ray tube producing a top-quality X-ray beam, the highest resolution digital X-ray sensor available today and a high-precision rotation device was then built. The results were as expected: the three-dimensional data, presented in the form of a film, revealed much more information on the tested pieces than conventional radiography. The obtained data is processed by special software which produces images with much higher contrast and sharpness.

The system which has been in use since November 2010 at the GEMLAB (Liechtenstein) laboratory has been extensively tested, and thus far about 150 three-dimensional radiographs of pearls, fissure-filled rubies and diamonds have been recorded. Selected screenshots of three-dimensional scans are shown in this article (**3** and **4**).

Discussion and concluding remarks

A new alternative X-ray technique to record three-dimensional radiographs has been presented. The method has the major advantage that the instrument needed is much more cost-effective

Gems and Minerals

Three-dimensional X-ray radiography (cont.)

than even the cheapest tomography system, not mentioning the high quality systems that are effectively needed for pearl analysis.

In approximately 150 test runs performed so far, the average three-dimensional X-ray scan took around 20 minutes, including sample preparation and data processing. As a consequence of this the analysis costs are far lower than a professionally performed analysis by a good X-ray tomography system.

The results obtained by this new three-dimensional digital X-ray radiography system prototype are evidently not as good as the data obtained by top X-ray tomography systems, but the information contained in complete scans is far better than what can be deduced from several isolated conventional radiographs. Good examples for the potential of this method are natural pearls from *Pteria penguin;* these pearls exhibit commonly only very indistinct structure and conventional radiography simply cannot resolve such structural details. In the *Pteria penguin* pearl scans conducted using this method we found very fine but evident concentric structure distributed along the scan. In order to be able to interpret the observed structure a 360° scan is necessary.

In conclusion, this new method permits the accurate determination and quantification of dense filler substances in gem materials and very detailed visualization of the structure of pearls, and all this with a very short analysis time and comparatively low cost for instrumentation and machine maintenance. Thanks to the ease of use of this new system and the urgent need of three-dimensional scans to be able to efficiently deal with the many difficult pearls that are circulating, we have recently decided that at the GEMLAB (Liechtenstein) laboratory no more natural pearl reports will be issued for nacreous pearls without a complete three-dimensional X-ray scan, meaning that each and every isolated nacreous pearl is analyzed using this new method. Since necklaces cannot be scanned by this method, our laboratory issues reports only for necklaces of *Pinctada* pearls if the radiographs are obvious and unambiguous.

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About the Author

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Jaded

Kerry Gregory reports on Edward Johnson's talk on jadeite, held at the Gem-A South West branch, and tests mystery materials with some unexpected results.

'A Story of Jadeite'

Having attended numerous gemmological talks, lectures and conferences over the years, as well as having read a plethora of gemmological journals and magazines, I have always found that the ones I find most interesting, enjoyable and useful are the ones that are practically based and relevant to what I do on a daily basis. I do appreciate laboratory research and complex testing equipment, but like the ending of a Hollywood film, it always feels a bit unreal and unlikely to ever happen in my life. So when I am booking speakers for the South West branch I try to keep this in mind. Many of our members can't afford the time or money to get to London to attend workshops and lectures, so we try as much as possible to keep the programme relevant, practical and useful to our members, who on the whole are what I would call everyday gemmologists — mainly retailers, valuers and students. We currently have a wish list of things we want to cover, but the two that top the list consistently are jadeite and opal.

In January on a grey, drizzly Sunday in Bath, we were lucky enough to cover one of these wish list top two with Edward Johnson, Director of GIA in the UK, who came and talked to us about one of his passions — jadeite — a stone that is frequently misunderstood, misidentified and misvalued in the UK. Before the talk we were discussing its title (simply entitled 'A Story of Jadeite') and Edward said to me: "There are many stories of jadeite; this is just mine."

He told us tales, history and lore about jadeite, referring to what it meant in Chinese culture. I find the story behind stones fascinating; as gemmologists we often look at stones as a series of inclusions and a list of constants, and forget that they are beautiful, precious and often magical to people. Most images, icons and scenes carved into jadeite have some form of symbolism or meaning to the Chinese — sometimes even a play on words. For instance, the Foushou — an acidic fruit which is also called Buddha's hand — not only resembles the deity's hand, but also sounds like the words Fu meaning 'blessing' and Shou meaning 'longevity'. Peapods are used to represent someone who is discreet about their wealth — the riches are hidden inside. Bats can symbolize good luck and peaches represent everlasting life. I can imagine auctioneers spending hours working out what the scenes carved into jadeite are, and then even more hours researching what this means.

One of my favourite stories of the day was about a jadeite carver who was asked by the emperor to carve a dragon and dogs out of a large boulder of jadeite. After having the boulder for many months and failing to carve anything out of it, the carver went to the emperor and told him that there were no dragons or dogs present in the jadeite, just a few koi carp swimming through the reeds. He was then told by the Emperor to carve what was in the jadeite. The emperor obviously realized that often the artist has to be told by the jadeite what to carve, rather than making the jadeite into what he wanted; a lesson we could probably all learn in gem testing and other areas of our lives!

Carved, natural jadeite sculpture composed of carp, lotus flowers, lotus leaf, lotus fruit, and lingzhi mushrooms. Credit: Gift of Sophie Leu.
© Gemological Institute of America. Reprinted by permission.

Moving on to qualities and values of jadeite, we were told that, as with most stones other than diamond, colour is the most important

Hands-on Gemmology

Jaded (cont.)

factor. Rich, vivid, evenly-coloured green, also called 'imperial jadeite', is the most sought after and the most expensive, with lavender jadeite coming second. Black jadeite is currently seeing an increase in the market place due to an increased supply from Guatemala, along with increased demand with more designers using black stones in their pieces. Uneven coloration will make the jadeite less valuable, unless the pattern is pleasing to the eye such as the 'moss in snow' effect — a white jadeite with green patches.

The texture of jadeite is also important in discerning quality. The finest texture of jadeite, termed 'old mine', takes the highest polish and has the smoothest texture due to the crystals being well interlocked. It is the most expensive, followed by 'old mine' (with a medium texture) and then what we mostly see in this country, the commercial 'new mine' jadeite with its coarse texture. The highest priced jadeite is semi-transparent, with lower transparency and opaque pieces being less valuable. The colourless variety of jadeite is often termed 'glassy' or 'icy'; these white and clear jadeites are now becoming highly prized. The other feature that fine-quality jadeite has is 'cui' (pronounced choi), an internal quality, a light or fire within the stone, making it more brilliant. I can only describe this quality as being the jadeite equivalent of the 'X-Factor'; it has to be seen to be appreciated and is very hard to describe or quantify.

As with most gemstones, jadeite is subject to treatment to add value to the product. Jadeite is classified as three types: type A — untreated material, sometimes only lightly waxed, and type B — this is bleached to remove unsightly staining, but as a result becomes unstable and has to be filled with polymer, resin or epoxy to stabilize it. With experience, the type B treatment may be identified by an etched surface on the material, resembling a spider's web, but be warned as this looks quite different to scratches or abrasion. This treatment is unstable and may break down over time, perhaps changing colour and making the jadeite unstable again. It is worth noting that with the increased demand for the more transparent jadeite this treatment is now also being used to improve clarity. Lastly there is type C — this has been artificially stained or dyed to improve the colour. A common treatment is the combination of types B and C which involves bleaching, filling and dyeing. The dye can often be recognized by a concentration of colour in the cracks, which look like veins running through the material. It has very hard edges — natural patterning in jadeite will generally have softer edges. The absorption spectrum of the dyed material is often altered; showing a broad absorption in the red end of the spectrum rather than the three fine chromium absorption bands as seen in natural fine green jadeite, with both showing the 437 nm line in the blue which is diagnostic for jadeite. As with most treatments it is much easier to prove that it has been treated than not — often complex laboratory tests are needed to categorically prove one way or the other. Jadeite has quite a few common simulants (a comparison table of constants can be found in the testing section of this article), most notably nephrite, which although a type of jade, is different enough to be distinguished and classed separately to jadeite, having a lower RI and SG and a different texture. Initially, as with most ornamental gemstones, distinction should be made through observation and confirmed with testing. Most jadeite simulants simply look different, which can only be learnt through experience and through looking at a lot of material.

Other simulants are Maw Sit Sit, chrysoprase, hydrogrossular garnet, doublets, glass, serpentine, vesuvianite (also called idocrase) and prehnite. Other than observation and the absorption spectrum, the refractive index (RI) can be useful if a reading can be taken — jadeite has an RI of 1.66 and if the item is unset you can calculate its specific gravity (SG), which should be around 3.32 for jadeite. A polariscope is not always useful, particularly if looking at opaque or almost opaque material, because many of the simulants are also polycrystalline in nature (rather handy if you have a piece of glass though). Failing that make friends with an expert, as a lot of us in the UK simply do not handle this material enough to gain the experience necessary to confidently identify and value jadeite.

Testing tales

After the talk we had our usual 'Ask the Audience' section, where members bring things that have vexed or impressed them, and coincidentally we were shown two stones that could be mistaken for jadeite.

1: Mystery green oval cabochon purchased from a jade cutter.

The first was a green oval cabochon stone (**1**) that had been bought in a job lot of stones from a gentleman who only cut jade. The new owner of this stone had pulled it out of the parcel because, as he said, "It just didn't look right" — an instinct that I possess, and always listen to. I don't always know what is wrong, but I am very much of the "guilty until proven innocent" attitude when it comes to stones. Looking at this stone I had an instinct. The stone was a minty green colour, with a greasy lustre, uneven coloration, a treacly looking interior and a slightly sleepy look to it. From these immediate observations my instinct was that this was a prehnite, because it looked a lot like many I had seen before.

I was wrong! On testing the stone I got a polycrystalline reaction from the polariscope, a spot RI reading of 1.65, a spectrum with a line at 437 nm, and a green reaction under the Chelsea Colour Filter, telling me that this stone was in fact jadeite. I hate being wrong!

Hands-on Gemmology

Jaded (cont.)

2: The QVC-marked ring with mystery pink stone.

The second stone was a pale pink opaque oval cabochon (**2**), in a fairly inexpensive yellow gold mount surrounded by diamonds, and sporting a QVC makers' mark. At first glance you might think that it was pale pink coral, or very opaque rose quartz. My instinct was pink opal, a stone that has become very popular of late, particularly with shopping channels. The gentleman that showed me the ring told me had obtained a spot reading of around 1.75 from the stone. This made me think the stone could be pink hydrogrossular garnet, often misleadingly called 'Transvaal jade'.

Testing the stone gave me a polycrystalline reaction on the polariscope, a spot RI reading of 1.45, and no discernible spectrum, telling me that the stone was pink opal. I love being right.!

Shortly after the jade talk I was in a charity shop looking for accessories for a fancy dress costume. Rummaging in a basket of bangles priced at four for £1, I saw something that made my eyes light up — was this an Imperial jade hololith bangle I held (**3a**)? My luck was in. I remember Edward saying one had sold for $2.5 million at auction 10 years ago, so this one must be worth twice that. My euphoria was short lived, however, because as soon as I picked up the bangle, even in the dim light of the Red Cross shop I could see

(a) Green bangle showing veining indicative of dye.
(b) Close-up showing glittery 'spangles', confirming the identity of the material as aventurine quartz.

the network of tell-tale veins indicating dye. Holding it closer I then saw the tiny reflections throughout (**3b**), like glitter on a birthday card, telling me it was aventurine quartz. So it wasn't a hugely valuable jadeite bangle, but not bad for 25p!

The morals of these testing tales are: accept that you may be wrong. Do not accept others people's data as fact; always test things yourself, and do trust your instincts, just make sure you test them! And finally, it is very unlikely that you will find a bangle worth millions in a Red Cross shop.

Properties of green gem materials.

	Hardness	Lustre	Transparency	Cleavage	Fracture	RI (mean)	Birefringence	SG
Aventurine quartzite	7	vitreous	translucent	none	conchoidal	1.55	n/a	2.65
Bowenite serpentine	5.5	greasy	opaque to slightly translucent	none	splintery	1.55	0.014	2.60
Chrysoprase	6	vitreous	translucent	none	conchoidal	1.53–1.55	n/a	2.60
Glass	5.5–6	vitreous	translucent to opaque	none	conchoidal	approx. 1.50–1.70	none	2.00 – 4.20
Hydrogrossular garnet	7.25	vitreous	translucent to opaque	none	conchoidal	1.70–1.73	none	3.30–3.60
Jadeite	7	greasy to vitreous	translucent to opaque	none	splintery	1.66	n/a	3.33
Maw sit sit	6–7	vitreous to oily	opaque to slightly translucent	none	uneven to conchoidal	1.52 normally but up to 1.74	n/a	2.50–3.20
Nephrite	6.5	greasy to vitreous	translucent to opaque	none	splintery/ hackly	1.62	n/a	2.80–3.10
Prehnite	6–6.5	oily to vitreous	translucent to opaque	distinct, basal	uneven	1.63	none	2.80–2.90
Vesuvianite/ idocrase	6.5	oily to vitreous	transparent to translucent	poor	sub-conchoidal	1.72	0.005	3.25–3.35

Shows and Exhibitions

Tucson 2011

All the colours of Tucson. Photo by Jack Ogden.

This year saw an amazing Tucson show, from the choicest rare gems to acres of the poorest grades. New treatments rubbed shoulders with new sources, and terminologies and disclosures ranged from the precise to the amusing. All this against the background of the coldest Tucson on record, but with some of the clearest skies: Jack Ogden reports on this year's Tucson show.

Coloured gems shine

That was the overall verdict from the gem sellers at Tucson this year. Many reported good sales, with most saying that sales were well up on 2010 with fine qualities in demand. This was summed up by Jeffrey Bilgore: "Rare stones are moving at the Tucson shows. What's moving most is people's perspective — a ray of sunshine as opposed to fear". When asked about colour trends Josh Hall of Pala Gems remarked that gems in pastel shades, including sapphire and spinel, seemed to be outselling stronger coloured stones now. If so, one wonders whether this might be due in part to the increasing attention of the media and trade to coloured diamonds.

Cut counts

Evelyn Tucker of Rogue Gems (www.roguegems.com) commented that tourmalines and sapphires in all colours were hot sellers and prices were on the increase. Evelyn was exhibiting her usual array of unusual gems and polished ornamental stones, with some fine green zircons from Sri Lanka among the former. Many of her cut and polished gemstones are cut by award-winning, and named, gem cutters. The increased 'branding' of individual cutters is a noticeable trend that we have commented on before. Fine cutting doesn't necessarily mean unusual shapes, it means cutting by an expert that truly understands how to maximise colour and light.

One cutter-turned-designer is Martin Key, who spent 30 years as a stone cutter. In that time Martin has won five Spectrum awards, and has been a jewellery designer for 15 years, designing pieces such as a ring with Mexican fire opal baguettes surrounding a blue tourmaline (**1**). Martin said, "The feedback I'm getting at my booth is that people are seeing things moving. From me, they are happy to see something new." Another example of combinations of unusual gems, fine cutting and inspiration was

Shows and Exhibitions

1: Martin Key's Mexican fire opal baguettes surrounding a blue tourmaline. Photo: www.robertdiamante.com.
2: Brenda Smith's Intrigue ring, composed of 18 ct white gold, prasiolite and mandarin garnet, with diamond accents.
(Inset) Intrigue ring viewed from the top, displaying effect of mandarin garnet. Photos by John Parrish.

epitomised in Brenda Smith's 'Intrigue Ring' (**2**). Brenda, formerly the creative director of an ad agency, bought a Cutting Edge award-winning prasiolite at Tucson 2010. Seeking a way to make it more colourful, Brenda experimented by placing an upside-down mandarin garnet beneath it (inset); "And then I had it," she said.

Soft cut

Among cutters, John Bradshaw is known for cutting the softer gems that other cutters avoid. Along with Brad Wilson he formed Coast to Coast Gems, which specialises in very rare faceted gems. Those who attended the Gem-A Conference in 2009 will remember Brad telling us of his close encounter with a polar bear while prospecting for gems in the far north. Coast to Coast Gems' inventory reads like an excerpt from an encyclopedia of rare minerals — and includes many I'd never heard of. It is impossible to enumerate what they were showing, but a deep red faceted proustite of 7.59 cts caught my eye — it sold just after I was shown it. Proustite, a silver sulfarsenide, is very soft at 2 – 2.5 on the Mohs' scale. Coast to Coast Gems' other treasures included cat's eyes in dumorterite and kyanite, plus hackmanites, scapolites and four smithsonites, each weighing over 20 carats. Brad and John's verdict of the show? The best ever.

Disclosure

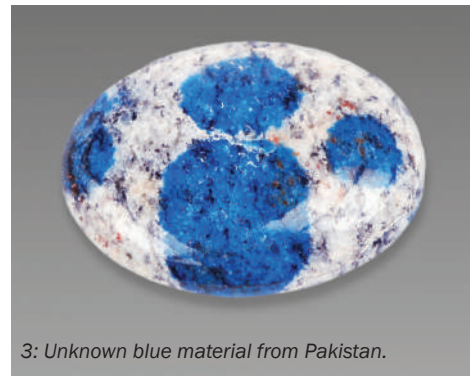
Disclosure with coloured gems was again more prevalent with some sellers than others, although the trend to label gems as 'natural' or 'unheated' when they are so continues to grow. Not all nomenclatures would soothe CIBJO's brow, with, for example amethysts in pink, purple and green, but my favourite disclosure label in the show was a tray of blue sapphires with the handwritten note 'defused'. In addition there was, of course, acres of amber, stuff masquerading as amber, and copal.

Something new, something blue

Among new sources for gems were brilliant rhodolite garnets from the Tocantins in the Peixe region of Brazil. Warren Boyd introduced an ornamental material consisting of bright blue hexagonally-shaped crystals in a white matrix from Pakistan (**3**). The nature of the blue material has not yet been identified — azurite and hauyne have been suggested — and a marketable name is being sought.

Opals

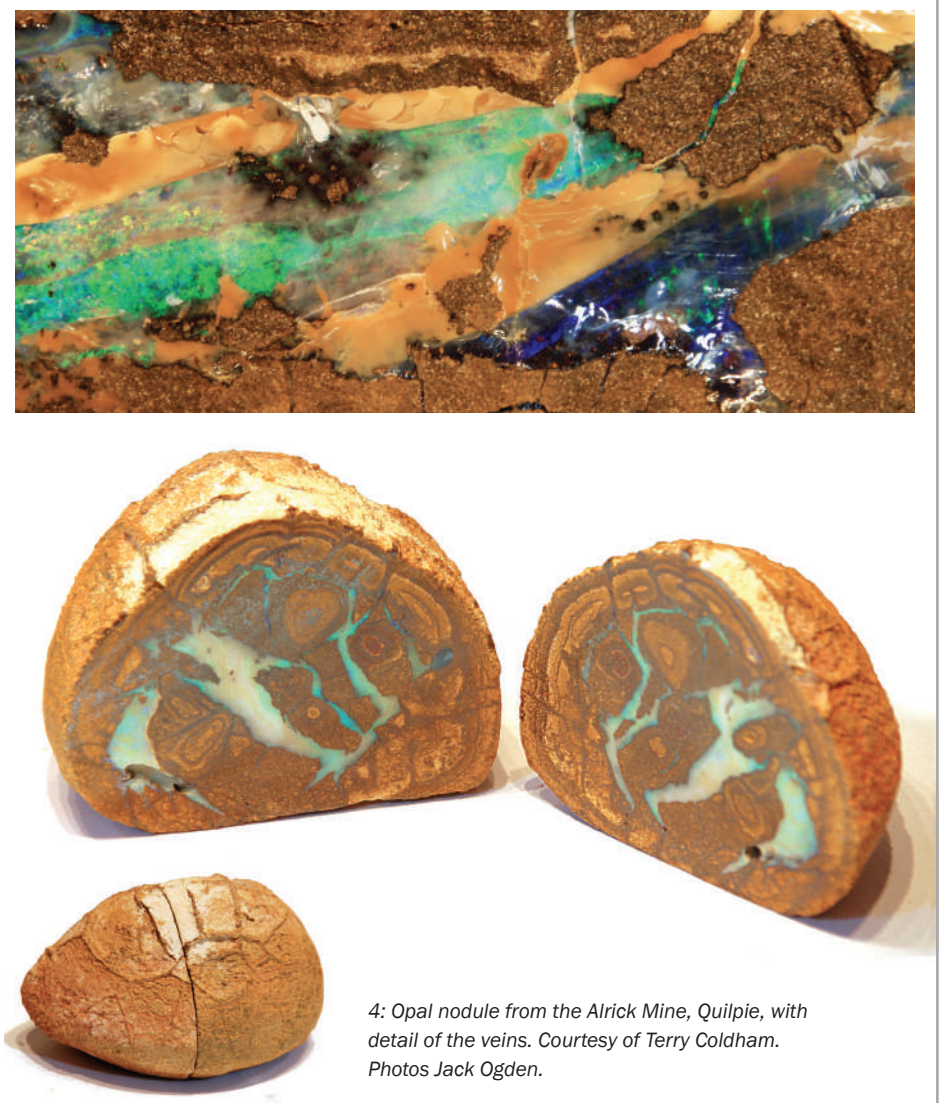
The abundance of Ethiopian opal was noteworthy. This material supposedly suffers less from the crazing problems that beset the earlier Ethiopian output, but rumours of some stabilization treatments continue to circulate. The impact of the large supplies of Ethiopian opal on sales of the Australian material is worth considering, but this is only likely to be relevant for the lower qualities of Australian opal — indeed fine quality Australian opal continues to be highly prized,



3: Unknown blue material from Pakistan.

Shows and Exhibitions

Tucson 2011 (cont.)



4: Opal nodule from the Alrick Mine, Quilpie, with detail of the veins. Courtesy of Terry Coldham. Photos Jack Ogden.

5: Treated garnets. Photo Jack Ogden.

and highly priced. Terry Coldham, of Sapphex Pty of Sydney, Australia, had some beautiful Australian opal in matrix including nodules from the Alrick Mine (**4**), Adavale, Quilpie, Queensland. Sapphex Pty also showed a range of untreated Tanzanian zoisite. The heat-treated brown that becomes tanzanite is far more familiar to most of us than the pretty, untreated, greens, blues and pinks also found.

New treatments

Ted Themelis had introduced us to his recent research on treatments during his full day seminar at Gem-A last November. It was both intriguing and worrying to hear about his work on treating garnet and spinel in particular; gems that, with minor exceptions, were thought to be essentially untreatable. Using a secret proprietary technique (elaborated on but not explained at the Tucson GILC Conference), he is able to improve the colours of some garnets and spinels (**5**). The technique involves heat, though not necessarily sufficient to show indications of its use, plus very finely divided additives of some sort. One might assume that it is some form of diffusion, but as Ted said (with a smile on his face), all heat treatment is diffusion really. Despite the views of some, I believe that Ted has every right not to divulge his long-researched technique and to get a good financial return from it. If he divulged it, it would soon be used by others. He does clearly disclose the stones as being heat treated, although he doesn't mention 'diffused'. Although the treated garnets seemed to be the focus of most attention at Tucson, the application of his new technique to rubies might prove the hardest commercial challenge. As samples showed, he can turn dark rubies into a far more desirable red, without seemingly affecting the internal characteristics in a way detectable with normal microscopic examination. Research will soon show whether the gemmological community's fears about detection are valid.

Emeralds

Emerald specialist Ron Ringsrud, author of *Emeralds: A Passionate Guide*, noted a

Tucson 2011 (cont.)

6: Colombian emerald crystals in calcite and pyrite from Muzo, in black shale from Muzo and in limestone from Chivor. Courtesy of Ron Ringsrud, photo Jack Ogden.

significant increase in Colombian emerald prices over last year — up 20% for mid-range commercial emeralds (in the $2000 - $3000 per carat price range) but with up to 50% increase for better qualities. In addition to Ron's faceted emeralds, he had some fine specimens of crystals on show, including some in matrix (**6**).

Emeralds were also the subject of awards, with The Indian Diamond and Colorstone Association recognizing London-based Gemfields as its Gem Mining Company of the Year at its annual dinner in Tucson. Gemfields focuses on high-quality and ethically produced Zambian emeralds. The award was accepted by Ian Harebottle, Gemfields CEO.

Gem-A at Tucson

The Gem-A booth at Tucson. (Left to right) Gem-A tutors Andrew Fellows and Claire Mitchell, with William H. Thielbahr and Dr Don Hoover. Photo by Jack Ogden.

Yet again Gem-A was very active at the Tucson show. As well as running a busy booth, Lorne Stather and Claire Mitchell presented seminars on distinguishing blue stones and the polariscope respectively. As usual the booth was a meeting point for Gem-A Fellows, members and students from around the world, plus those drawn by the increasing reputation of our courses in America and who wished to learn more about studying with us.

Competition: 'Brain Waves'

We at the Gem-A booth were posed a deceptively simple question. If you place a transparent doubly-refractive gem on a polariscope so that the singly refractive *c* axis passes vertically up through the crossed polars, the gem appears consistently bright as it is rotated through 360°. Intuitively one might expect it to stay dark, behaving like a fully singly refracting material, but it doesn't. Why? How might you explain this to a student without detailed knowledge of optics?

Answers to information@gem-a.com (with 'Brain Waves' as the subject) or mail to Brain Waves, Gem-A, 27 Greville Street, London EC1N 8TN. Answers by 31 May please.

Bringing back the old

Olga Gonzalez reports on new and old trends at Tucson 2011.

Snoverkill happens ... which is why we look forward to Tucson! For those who graced the gem shows this year, the appearance of sweaters in the desert was definitely new to the market. C'est la vie ... at least the gems were still there.

My mission was to get an indication of how the industry was looking these days. What sells? What's new? How does one stand out in a city with over 40 shows? What do people have to say? For answers to these serious questions I would need more time in Tucson, and so naturally I doubled the length of my stay from 24 hours last year to 48 hours.

My first stop was at the booth of Brenda Smith at the AGTA show. As has been mentioned, Brenda was selling an award-winning prasiolite and mandarin garnet 'Intrigue' ring; the garnet gave the prasiolite an incredible flash of colour through the table — a delight to see. Nearby, Martin Key (also mentioned) was standing with his signage, where he had amusingly crossed out the text that said he had won three spectrum awards and had written a very official looking 'five' over the 'three' in black marker pen.

Main photo: The Carina Organics stand at Tucson.
Above left: 'Charmed' charoite necklace.
Above right: 'Intricacies of the Heart' cobalt calcite drusy necklace and earrings.
All images © Carina Rossner Organics.

A theme I saw throughout the gem shows was the idea of the 'perceived new'. Although I didn't see much in terms of innovation and new goods flooding the market, I did notice resurgence in bringing back the old so it is 'like new'. Several exhibitors I had spoken to pulled pieces from older stock that hadn't been seen in a while. Perhaps this is a sign of the times and of our tendency to back away from waste and excess stock, but dealers and designers have definitely been merchandising and bringing back some older styles. Brad Wilson from Coast to Coast echoed this sentiment when he sold out of nearly all the revived pieces he brought with him: "This has been a stellar show for us. We resurrected some old pieces, and for those who are shopping they are new."

However, what was new were the designers. Throughout the show, I was surprised at how many people were exhibiting for the first or second time in Tucson. From the fun and playful jewellery of Carina Rossner Organics (pictured) to the exquisite Salvador Dali-inspired gemstone cutting of Sonja Kreis, up and coming designers are everywhere. The competition between designers may become tougher, but aesthetics will prevail and it will be interesting to see whose style will become the new 'classic'.

Jeffrey Bilgore made one of the most poignant observations heard while there. In addition to his comments on rare stones he was heard to say: "'OK' is the new 'great', and people have adapted to the changing economy. As always, the industry will survive." Whether it's retiring and becoming a designer, showing an old stone in a new way or being a leader in education for the industry, the presence of those at the Tucson Gem Shows has kept the jewellery buzz going.

Gem-A tutor Andrew Fellows reflects on his debut visit to the Tucson Gem Show.

First impressions

Nothing can prepare you for the size and scale of the Tucson Gem Show, particularly when you see it for the very first time. No matter how many articles you've read, they never really convey the sheer number of exhibitors or stands that pack every hotel, motel, tent and conference centre in this small town. Every gemstone and every treatment you've ever heard of is available here (along with many you haven't), and the vast array means that even with just a cursory glance at each stand you'd still be hard pushed to cover every single one.

My whirlwind tour started with a night flight into Tucson International Airport, where I was met by my colleague, host and guide for the week, Don Hoover, a well-known US gemmologist. A packed itinerary lay ahead of me, with show tours, meetings, seminars, and talks provisionally arranged — no chance of boredom here! I was privileged to be at the show as a guest of Stone Group Labs (Cara and Bear Williams), with whom I have had a long-running email relationship, and who, along with Don, guided me through one of my most enjoyable weeks to date. Without these three, I doubt that I'd have met or spoken to a fraction of the interesting people that I encountered.

Tucson is not one show, but a collection of many differently sized shows, some major, some minor, but all having their own individual style and appeal, and all with something new to offer. You can buy just about anything, from natural and synthetic diamonds to fossils — in some cases in sizes that would definitely exceed any airline's baggage allowance.

Even though the weather was bright and clear it was the coldest Tucson on record — certainly not a problem for us Brits!

I concentrated on the AGTA, GJX and Tucson Motel shows, for no other reason than they were conveniently situated, and housed the people that Don thought I would be interested in meeting; people such as Ted Themelis, Terry Coldham (President of the Gemmological Association of Australia) and John Dyer (whose gemstone carvings must be seen to be truly appreciated). These people, who, under normal circumstances, I would rarely get to speak to, were discussing the latest developments and market trends with me as though we were lifelong friends. I was even lucky enough to meet with a Brazilian mine-owner and a geologist, both of whom had known Don for years and who readily accepted me into their discussions; particularly a discussion about the practical difficulties and problems of mining, which are sometimes overlooked in favour of the more theoretical ones that so often appear in texts. These conversations taught me much, and in themselves would have made the trip worthwhile, but there were also the more formal seminars arranged by various groups and individuals on numerous topics.

Two of the best-received seminars (in my opinion) were those presented by Lorne Stather and Claire Mitchell of Gem-A (the subject matter being blue stone separation by CCF and London dichroscope, and the polariscope respectively). I was present at both, and although using what could be considered relatively simple and easily portable equipment, these seminars both left the audience informed and, perhaps more importantly, saying that they had enjoyed them — gemmology should always have a fun aspect to it, I find it makes it easier to remember!

Outside of these seminars and meetings, my time was taken up wandering around the many stands, being amazed at the variety of gems and their quantities. Ethiopian opals seemed to be big this year, making appearances on more stands than possibly anything else, and like many I succumbed and bought some rough samples. Other purchases included garnets of varying types, and the ever-present glass-filled rubies, which, at $1.50 per carat, were probably more glass than anything!

Evenings were spent discussing the days' events over dinner, or reflecting on that day's purchases and how they were to be packed for the return trip. One such evening saw gemmologists attending the AGA's Gala Dinner; a very enjoyable meal with a silent auction afterwards; unfortunately I didn't manage to bid successfully for anything.

The week passed far too quickly, and before long it was time to head for the airport for the flight home, with a head full of information and memories, and the seeds of plans for next year's show.

If you've never been to Tucson, you're really missing out on part of your gemmological education — nowhere else can you see so many different gem materials in such a short space of time. Start making plans for Tucson 2012 — and don't forget your sun-cream!

Gem-A Calendar

April

26

POLARISCOPE

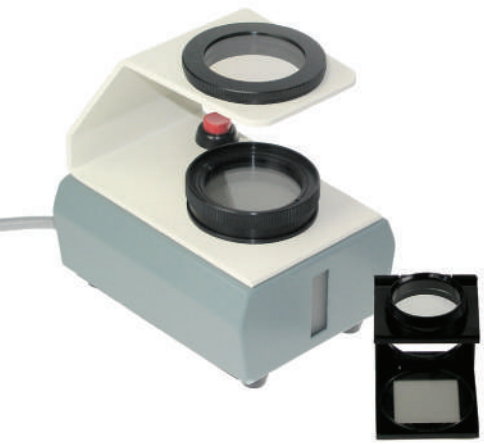
Gem Discovery Club

Gem-A's London headquarters

6:00 to 8:00 pm

Kerry Gregory, a Gem-A distance learning tutor and *Gems & Jewellery* contributor, will talk about getting the most from a polariscope, with plenty of useful tips and hands-on practice. This is a perfect opportunity for members and students to brush up their skills with this useful but often underestimated tool.

Contact fiona@gem-a.com to reserve a place.



29 April to 2 May

SCOTTISH GEMMOLOGICAL ASSOCIATION 2011 ANNUAL CONFERENCE

The Queen's Hotel, Perth

This year's SGA Conference promises to be a weekend not to be missed. This popular event attracts speakers and attendees from all around the world, with lectures, workshops and excursions.

Programme

Friday evening will commmence with Professor Marchia Pointon's talk on 'The love of stones: Mineralogy, art and education in nineteenth-century Britain' and will be followed by a buffet meal.

On Saturday morning Dr Karl Schmetzer will start the day with his talk, 'A gem of a birthday present? — the history of the discovery of alexandrite', and will be followed by talks entitled 'Specific gravity' by Alan Hodgkinson, 'Testing precious gemstones in Hong Kong' by Dominic Mok and 'Market trends and other illusions from the trade' by Stuart Robertson.

Dr Karl Schmetzer will open Sunday's programme with his talk on 'Alexandrite — a special stone for experts, enthusiasts and connoisseurs', followed by David Callaghan's talk entitled 'What a wonderful world?'. Various workshops will follow, and the SGA will be selling various books and instruments.

Social events are held each evening, including the highly popular Ceilidh (dinner/dance) on the Saturday.

Excursion

There will be a visit to the National Museums of Scotland, Edinburgh, on the Monday.

Please check availability for all events.

To book

For availability and booking please visit www.scotgem.co.uk or contact Catriona McInnes on +44 (0)131 667 2199.

Gem-A Calendar

May

13

THE GENIUS OF RENÉ LALIQUE
Gem-A Midlands Branch Meeting

Earth Sciences Building, University of Birmingham, Edgbaston
6:30 pm
A presentation by David Callaghan FGA, former Chairman of the Gemmological Association and Director of Hancocks. The talk concentrates mainly on the extraordinary jewels created by René Lalique for his one-time patron, Calouste Gulbenkian. Lalique's ideas and technical achievements became a huge inspiration to other designers and craftsmen. The talk concludes with a 'tour' of his lasting monument — the 'Glass Church' at St. Martin in Jersey.

31

ZAMBIAN AMETHYSTS
Gem Discovery Club

Gem-A's London headquarters
6:00 to 8:00 pm

A presentation by Cyrille Djankoff — a director of Kariba Minerals Ltd (see www.karibaminerals.com). Kariba has an estimated market share of more than 90% of the amethyst originating from Zambia and is arguably the single largest amethyst producer in the world. The company exports mainly to China and India, but also has clients in Europe and America. Cyrille is also sales executive for UK based Gemfields, producers of Zambian emeralds.
Contact fiona@gem-a.com to reserve a place.

June

6 - 12

LONDON JEWELLERY WEEK

A week of events celebrating contemporary jewellery and design, with events hosted in and around London. For more information please visit www.londonjewelleryweek.co.uk

11

HATTON GARDEN FESTIVAL

Part of London Jewellery Week, this annual celebration of London's traditional jewellery district is the perfect day out for the whole family. Come and visit Gem-A's stand or check out the jewellers of Hatton Garden, all whilst soaking up the exciting atmosphere.

27

SCOTTISH GEMMOLOGICAL ASSOCIATION AGM

British Geological Survey, Edinburgh.
7:00 pm, doors open 6:30 pm
Scottish Gemmological Association's AGM, followed by a talk by Dr John Faithfull on 'Mobile Phones and Gemstones from the Rare-Element Pegmatites of Mozambique'. Following his recent visit to Mozambique, John will describe his experiences of gem mining there with particular reference to pegmatites and coltan (columbite-tantalite) rare earth minerals.
Free to paid up members of SGA.

Save the date

September

4 - 7

INTERNATIONAL JEWELLERY LONDON EARL'S COURT 2

Meet the Gem-A team at this year's IJL. Watch this space for our stand number.

November

6

GEM-A ANNUAL CONFERENCE

The 2011 Gem-A Conference will host a day of gemmological lectures from speakers at the forefront of their fields, followed by a dinner/disco in the evening. The day promises to be exciting and informative.

7

GEM-A GRADUATION CEREMONY AND PRESENTATION OF AWARDS

Goldsmiths' Hall, London.
A celebration for this year's graduates. The ceremony will be followed by a reception for graduates and their guests.

For the latest information on Gem-A events and workshops go to **www.gem-a.com**

Organics

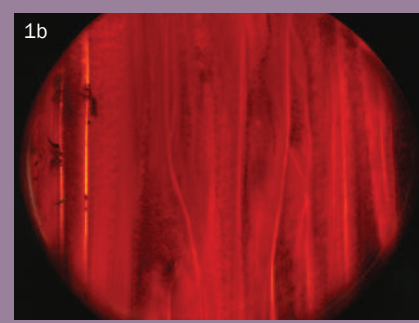
Red Australian Cape York amber

Maggie Campbell Pedersen reports on a new type of red amber discovered in Australia.

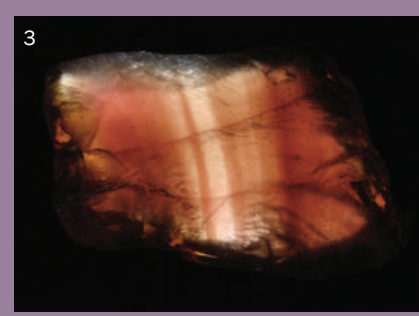
Various ambers can develop a red surface colour as a result of oxidation, whilst some display red veins in the flow lines caused by geological processes over the millions of years they have taken to form. Most of the 'red amber' we see on the market is treated Baltic amber, and we are now also seeing the red-coated variety (see *Gems & Jewellery*, Winter 2010). And of course we have the red, phenolic resin simulants, commonly called 'Bakelite'.

There are ambers that look brown by reflected light but red by transmitted light; for example, some of the apparently dull, dark brown material from Borneo. However, natural amber with a red body colour is extremely rare. The best known is burmite — the Cretaceous amber from Burma. Burmite occurs in yellows and browns, as well as a very small percentage in the famous clear red. This material is a transparent, slightly rust-red colour all through, although under strong magnification the colour appears to be caused by minute particles within the otherwise yellow resin. The yellow and brown varieties of burmite often have a hint of red and sometimes swirls of reddish colour.

I had heard that some of the Australian Cape York amber is red, but descriptions — and indeed photos — can often exaggerate, and I was therefore delighted to take delivery of some of the 'red' material recently and to be able to judge for myself.



1: A deep red cabochon viewed by (a) reflected light and (b) transmitted light, showing colour banding.
2: A paler red cabochon viewed by (a) reflected light and (b) transmitted light.
3: Colour bands in a small piece of rough viewed by transmitted light (magnified).



Observation

Some of the Cape York amber is indeed red. The red colour seems to occur in a way similar to that of burmite, with bands or swirls of minute particles which colour the body of the material. By transmitted light it can turn a brilliant, cherry red (**1b**) — as can be the case with burmite.

Being so old, burmite is often cracked. That appears not to be the case with the Cape York material which is much younger. Though they are far from certain as yet, the scientists who are investigating the amber at the University of New South Wales in Sydney estimate that it could possibly be about 12 million years old.

Testing

When tested with a hot point and solvent, the material gave surprising and conflicting results, as it appears to be inert to solvents (indicating amber), yet has a low melting point. When touched with a hot point, the point readily entered the material and drew threads of melted resin out as it was retracted, indicating copal. To hazard an unscientific guess, I would think that the material is probably very young amber, this is because other 'young' ambers such as those from Borneo (reckoned to be about 15 million years old) are also inert to solvents, yet a hot point can make a deep indentation in the material.

There is much to learn about the Cape York amber, but one thing is for certain: it is beautiful material.

References

Jack Ogden, 2010. 'Conference 2010'. *Gems & Jewellery,* **19**(4), 9

All photos © Maggie Campbell Pedersen.

For more information about red ambers, including Cape York amber, log on to www.maggiecp.com and click on 'Organic Gems'.

Around the Trade

Keeping up with the gemmologists

Harry Levy discusses the hot topics raised by members on Gem-A's MailTalk.

For those of you who do not know, Gem-A has an email-based forum called MailTalk which is open to all members of Gem-A. Started by Jack Ogden in 2002, it transferred to Gem-A in 2004, and has become a most wonderful debating group. New developments are posted by members, questions are asked about new and old products on the market, and much gemmology with its applications, terminology, disclosure, and lots more, is discussed.

Reading many of the comments it is clear that there are many issues that are not understood, misunderstood, and also not properly applied. Because of this I thought that in the future I would include the hot topics in my column to try and tackle problems that arise and how we explain these depending upon whether we are traders or pure gemmologists seeking only the truth.

'Natural' gemstones

An issue that has generated a long and stimulating debate on MailTalk is the use of the term 'natural'. For many years it has been agreed and understood that when a gemstone name is used on its own it refers to a natural product; if it is not natural then it follows that the term has to be modified. For example, sapphire when used on its own refers to a natural sapphire; if it is synthetic then we must call it a 'synthetic sapphire'. This is very important as there is usually a large price differential between the two.

Let me explain the natural/real case. These terms tend to be used synonymously in gemmology. We can sell a natural sapphire as a 'natural sapphire' or a 'real sapphire'; if anything, the consumer seems to prefer 'real sapphire'. But the two terms are not synonymous in all cases. We can talk of a real/imaginary contrast, but it makes no sense to have a natural/imaginary division. An easily understood context is the division between 'natural' or 'real sapphire' and a 'synthetic sapphire'.

The other side of this argument is that when buying loose gemstones or gem-set jewellery, the consumer is aware that synthetic stones are being marketed and thus may want a positive statement by seeing the words 'natural' or 'real' used on invoices. Laboratories have accepted this argument and most will, when producing an identification certificate, call it a natural gemstone or a gemstone of natural origin.

It is difficult to understand why there are those who do not wish to use the term 'natural'. A gemstone of natural origin will not always be prefixed with the word 'natural', but may be when the context or a customer requires it.

Mineralogy

The protesters further argue that mineralogists do not use the term 'natural mineral', and since gemmology is derived from mineralogy then it would be wrong for us to contravene the mineralogical definitions. I approached the mineralogy aspect through a colleague and was surprised that mineralogists too have a forum similar to Gem-A's MailTalk. It was quite clear that in their view a mineral must be a natural product, thus it makes no sense to talk of a natural mineral. I then posed the question of how they would classify, say, synthetic quartz. Quartz is a mineral, thus natural by definition, and to call something a synthetic quartz would be an oxymoron, namely a 'synthetic natural quartz'. I was amazed by the response to this question. Some did not answer the question, some did not understand it, some came out with alternatives to quartz and suggested synthetic SiO_2, or some other terminology that did not use the term 'quartz', but a term similar to it. If quartz can be replaced by a similar term then all the problems attached to natural and synthetic quartz will follow through to the alternative term.

Many mineralogists understood and acknowledged the problem. It will be interesting to see what happens to this debate — if they are anything like our gemmologists it will take them another 100 years to come to a resolution. To me, one sensible solution would be to

CIBJO Congress

The CIBJO Congress held in Porto, Portugal, from 14 to 16 March made more progress than usual. There is now an attempt to edit the three parts of the *Blue Book,* namely Diamonds, Gemstones and Pearls, into a similar format and make them easier to use. To my mind it would be better to have one book only and have sections where needed to differentiate between different products.

The Coloured Stone Commission passed, by a very narrow margin, a resolution to permit the use of terms 'laboratory grown' and 'laboratory created', as well as 'synthetic'. There is a powerful group within CIBJO who abhor change and whenever anything new is suggested their inclination is to vote against it. There also seems to be an obsession with the term 'synthetic' as being the one and only term that should be applied to all man-made stones. In the discussion, one delegate declared that there was no ambiguity with the new term proposed, but he would vote against the additions in order to maintain CIBJO Standards. I fail to understand such logic; the aim of conferences is to change standards as and when this becomes necessary.

The term 'natural' was the subject of long debate by the Coloured Stone Commission at the Congress. It was finally agreed that 'natural' should be permitted as an addition to the name of the material (for example 'natural diamond' and 'natural sapphire') provided that the material was indeed natural. The matter was more complex in the Pearl Commission however. There the proposal was to abandon the term 'pearl' on its own and always prefix it with 'natural', 'cultured' or 'imitation'. Many wished to retain the term 'pearl' on its own for the natural product. No vote was taken and it was referred to the next Congress.

drop the necessity that a mineral must in all cases be natural and admit synthetic minerals into their lexicon. These synthetics are now extensively produced and used in industry; they are experimented on in laboratories and new ones produced every day. To claim that synthetic quartz is not quartz no longer makes sense. The term synthetic quartz is commonly used in the electronics industry.

Fashioned material

However, some legislators want to claim that a synthetic sapphire is not a sapphire, and a synthetic diamond is not a diamond. The argument that synthetics are different because we have tests to differentiate between them is untenable. We can differentiate between many types of natural sapphires, say Australian ones from Sri Lankan ones, but it does not follow that only one type is a sapphire and the others are not and should not be called sapphires. Arguably a more complex problem is how to refer to a natural stone that has been treated. Does it still remain a natural stone?

Again there are arguments to support both positions. When I was corresponding with the mineralogists, one person said that a diamond crystal dug out of the ground was a mineral and therefore natural. Once it had been worked in cutting and polishing it was no longer natural, and so I suppose in his lexicon it was no longer a diamond. Our disclosure regulations tell us that we cannot refer to a treated sapphire just as 'sapphire' but that we must therefore refer to it as a treated sapphire. Since we cannot refer to such a stone as a 'sapphire' with no terms added, then it is no longer natural.

Disclosure

We get into all sorts of strange positions if we continue our arguments along similar lines. CIBJO, in its wisdom, advocated two types of disclosure — general disclosure and specific disclosure. General disclosure was designed to deal with treatments that were often carried out, such as the oiling of emeralds, heating of sapphires and aquamarines, as well as the staining of agates. It replaced another term, namely 'accepted trade practice'. General disclosure should be a statement put on an invoice to explain the above examples. Specific disclosure was to cover things such as the coating of sapphires and using coloured oils on emeralds. In this case one had to use the term 'treated'. In neither case was it necessary to state the actual treatment.

Another problem raised is the fracture-filling of, for example, rubies. The stone is heated on a bed of borax, and when this is cooled it remains as glass in the stone. Our accepted definition of a synthetic stone is a stone that has been wholly or partially made by man, so a ruby that is fracture-filled should in fact be called a synthetic ruby.

To argue the other way, it seems strange to claim that a natural diamond that has been lasered and had a hole drilled into it ceases to be a natural stone, or that heating a sapphire stops it being a natural material. An illustrative example to look at is yellow diamonds. We have natural diamonds, we have natural diamonds that are irradiated and/or heated, diamonds that undergo HPHT, and lastly synthesized diamonds, such as those produced by Gemesis. We need to differentiate between these as they fetch different prices on the market place and few people would like to equate irradiated diamonds of natural origin with synthetic ones.

As can be seen, problems that seem simple can become very complex. The language we adopt depends on what we wish to do with our stones.

About MailTalk

To join MailTalk or for more information about the service, visit http://www.gem-a.com/membership/mailtalk.aspx or email Gem-A at membership@gem-a.com.

Around the Trade

KP — the continuing saga

The diamonds from the fields in Merange in Zimbabwe, discussed in my article 'KP-Plus' in the Winter 2010 issue of *Gems & Jewellery*, continue to plague the KP.

There was a partial solution in St Petersburg last July, when it was agreed that Zimbabwe could release some of its stockpile of diamonds if it agreed to release and drop all charges against a local NGO. Zimbabwe would then have to give undertakings to improve Human Rights issues for local artisan miners in the diamond fields. When this had been verified it could then resume exporting its diamonds through the KP.

For a country like Zimbabwe, a signatory to the KP, there is no other way to export its stones legally. Talks in the KP have not gone smoothly. One problem is that there is nothing in the KP Charter about Human Rights and its abuses — it appears that some KP members did not wish to expand the KP remits. One solution suggested was to introduce a new format of the KP, known as KP Plus, a system strongly supported by Canada and Australia as well as the USA. Other members of the KP thought that this would introduce a two-tiered system into the KP and would become prejudiced against the African countries, where there are still conflicts and, hence, human rights abuses. It should be noted that both Canada and Australia are significant producers of diamonds now, and are conflict-free.

The KP has a rotating 'Chair' (effectively a presidency) and secretariat. The presidency remains with each country for six months before it moves on. It has been with Israel for the past six months, but they were unable to solve the Zimbabwean problem. The presidency has now moved to the Democratic Republic of Congo (DRC) who have had conflicts for many years. Given that African countries might have loyalties to each other, it will be interesting to see what will happen now.

There are rumours that some distributors could break away from the KP altogether and start up their own system of distribution, guaranteeing that their stones would comply with the KP but also be abuses free. How such a guarantee could be shown to be effective is problematic. As a result of this — amongst claims that there are shortages of rough diamonds, and that some Zimbabwean diamonds are finding their way into the international gem markets (and thus bypassing the KP), as well as continued stories that De Beers is continuing to lose its market share — it is difficult to know exactly what the rough market is now like. Another complication is that India, the largest cutter and polisher of diamonds, lost much of its work force during the recession a couple of years ago. It seems that many of these people will not come back to the cutting factories, as they have found jobs in more stable environments than the diamond trade can provide, and so there are now not enough cutters and polishers.

Harry Levy

Freddy Hager
1948–2011

It is with great sadness that we announce the sudden death on 7 April of Freddy Hager, a well respected figure in the diamond industry.

"He was a much loved and respected part of the diamond trade, and always a friend to and supporter of Gem-A," said Jack Ogden. "His friendly nature and great intelligence will be greatly missed."

Freddy entered the diamond business in 1974 in London after earning a degree in Economics at University College London. In 1980 he was elected to the Management Committee of the London Diamond Bourse. In 1991 he was elected President of the London Diamond Bourse and three years later he oversaw the merger of the London Diamond Bourse and the London Diamond Club into a single body.

He was elected to the WFDB's Executive Committee at the 29th World Diamond Congress in Antwerp in 2000, and has since served as Deputy Treasurer General and as Chairman of the WFDB's Trade and Promotions Committee. He was a founder member of the World Diamond Council and is considered the spiritual father of the Federation's better business symbol, the WFDB Mark.

Avi Paz, President of the WFDB, said: "The loss of Freddy is immense for so many of us. He was a friend, a mentor, a visionary and a person who worked tirelessly behind the scenes for the WFDB, his bourse's own members, his community, and of course for his family. He was a gentleman who was always absolutely frank and straight-forward."

Freddy is survived by his wife Louise, four children and grandchildren.

In the news

Gem-A Diamond Scholarship Awards

Our congratulations go to Caroline Kernick and Natalia Shroder, winners of the 2011 Gem-A Diamond Scholarships in the Craftsmanship & Design Awards. Organized by the Goldsmiths' Craft and Design Council, the Awards aspire to promote excellence in silversmithing, jewellery and the allied crafts. The awarded scholarship entitles Caroline and Natalia to complimentary study of Gem-A's famous five-day diamond grading course, a hands-on class which leads to Gem-A's Diamond Practical Certificate.

Jack Ogden, CEO of Gem-A, said "We are pleased to award the scholarships to Caroline and Natalia. The designs of both are unique and edgy, and they will clearly make good use of the diamond knowledge they gain with Gem-A. The Diamond scholarship will enhance their practical knowledge and understanding of diamonds, providing them with confidence to use diamonds in exciting ways in their pieces."

Natalia Shroder

Natalia Shroder, a former student at London Metropolitan University and currently employed by Electrum Gallery, London, submitted 3D designs for a set of silver and gold-plated orchid rings (below) and for a leather face adornment piece and glove. Said Natalia: "Winning the Gem-A Award is an incredible honour and the greatest satisfaction for me. I have invested a huge part of my soul and passion into creating the orchid rings, and this Award acknowledges all my efforts and my unusual design concept. I will finally be able to add that missing brilliant sparkle of the most exquisite stones to my creations."

Orchid rings by Natalia Shroder. Courtesy of Natalia Shroder, photo by Daniel Gaska.

Caroline Kernick

A student at Central St. Martins College, London, Caroline Kernick submitted designs for a tumbling necklet (below), an entwined bracelet and a brooch. Said Caroline: "The Gem-A course will give me a unique opportunity to extend my grasp and appreciation of diamonds, thus learning to create with respect and understanding. One must be fully familiar with the properties, provenance and meanings of their chosen materials before using them confidently. I have long felt that gaining a thorough understanding of diamonds needs to be part of my training to strengthen my base as a fine jewellery designer. I am greatly looking forward to the course in July where I hope to meet like-minded diamond enthusiasts!"

Photo © The Goldsmiths' Craft and Design Council. Photographer Bill Burnett.

Gem news from Gary Roskin

Gary Roskin FGA presents a selection of recent gem news and comments from *The Roskin Gem News Report*. Here he looks at what to call glass-filled ruby, mislabelled Tahitian pearls, fake moonstone and the HPHT treatment of large diamonds.

Glass-filled ruby — still confused over what to call it?

There is today an overabundance of jewellery set with red glass-filled corundum, otherwise known as glass-filled ruby. That's just one name for this material; like the material itself, there is also an overabundance of names used to describe it. It seems to be a continual quest for gemmologists, suppliers and retailers to come up with a better label, a more descriptive label, a more saleable label for this 'stuff'.

During our recent trip to Tucson's gem and mineral shows in February, we were presented with a tray of natural, untreated and highly fractured corundum; opaque and reddish, but mostly of a dark, slightly reddish-purple hue, and labelled, what else, 'ruby' (**1**). We handled the material which, priced at $1 per carat, was fairly solid and not crumbling to the touch as some can be. However, you would definitely not mistake this material for gem-quality ruby, not by any stretch of the imagination.

The tray beside this 'ruby' was piled high with bright red vitreous semi-transparent to translucent material, and simply labelled '$3 per carat'. When asked what the material was, the owner of the gem company stated that it was "the same ruby as this [pointing to the previous tray] but heated and processed".

'Heated and processed'? It is non-gem-quality reddish corundum that has been heated and filled with a high refractive index glass. The high refractive index glass helps mask the inherent fissures and fill internal and external cavities, thus creating transparency. It also fuses the material together, making it much more durable. The yellow body colour of the glass blends nicely with the colour of the rough to create a bright ruby red. Lastly, because there is so much glass added to the rough material, the weight has now increased and, for some pieces, quite dramatically.

In the piece that we purchased, you can see that not only has the colour, clarity and stability been enhanced, but many separate pieces of rough have been fused together, which can now be cut and polished as one larger stone (**2**).

So what do we call it? One of the more obvious names used is 'glass-filled ruby', which happens to be our label of choice for the moment. However, it can also be called 'lead glass-filled ruby' (although there is bismuth glass-filled ruby, and may be other formulas as well). There is 'treated ruby', 'enhanced ruby' and 'heated ruby', which does not distinguish itself from gem-quality ruby that has been heat treated. Then there is 'filled ruby', 'fissure-filled ruby', 'a hybrid gemstone', 'glass ruby', 'ruby with glass', 'ruby glass composite' and 'composite ruby'. There are also those who are trying to distinguish between different qualities of this material by commenting on how much glass has been used. No pun intended, but it has been and can be a heated debate.

1: Before and after: Untreated corundum rough (left) and a glassed-filled and heated 'composite ruby' (right).

2. At least four separate pieces of corundum rough were filled with, and fused together by, high refractive index glass to form this 25 ct 'composite ruby'. Described by the seller as 'heated and processed ruby'.

Gem-A News and Views

Last but not least, because of the quality (or lack thereof) of the starting material, we have those who question whether or not it should even be labelled with the term 'ruby'. Unfortunately, there is no quality distinction made in mineralogy or gemmology for the term ruby. Ruby is simply red corundum.

The AAA quality Tahitian strand

What would you expect to receive from an eBay seller if you purchased what they labelled as a "strand of 8 — 8 ½ mm AAA quality Tahitian pearls", priced at $25 for the strand, including shipping?

We know that you shouldn't identify gems by their cost, but a strand of AAA quality Tahitian cultured pearls for $25, shipping included, surely must be something else.

We wanted to find out exactly what the pearls were and so ordered them. This is what we received: a strand of Chinese freshwater cultured pearls that had been coloured by silver nitrate solution to make them appear similar to the colour of Tahitian cultured pearls (**3** and **4**). To make certain of the colour treatment, we gave the strand to the GIA's Gem Laboratory in New York. Upon testing the pearls they found a lot of silver. Soaking pearls in a silver nitrate solution is the most popular treatment for creating black pearls, and that's what we got.

When we contacted the seller to tell him that he had sold us Chinese freshwater dyed cultured pearls, he apologized and was quick to offer a full refund, but how many other buyers would even know to ask for a refund?

But the label says that it is moonstone

Just because the label says that it is moonstone, doesn't mean it is moonstone. But that's not what amateur crafters believe. After meeting several (more than a half dozen) jewellery hobbyists selling handmade 'moonstone'-set jewellery at holiday craft fairs, we were more than curious as to why these people were so adamant that what they were selling was indeed genuine moonstone. To us it was obvious that it was plastic (**5** and **6**). Two crafters claimed that their "New York supplier goes to India" and brings back some of "the finest material" possible. That certainly is possible, but that's not what they bought.

On a quick shopping trip to Jo-Ann Fabric and Craft stores, we found the same 'moonstone' beads, right alongside plastic and glass beads. But we would never have believed what we found next: the label actually calls these plastic beads 'moonstone'.

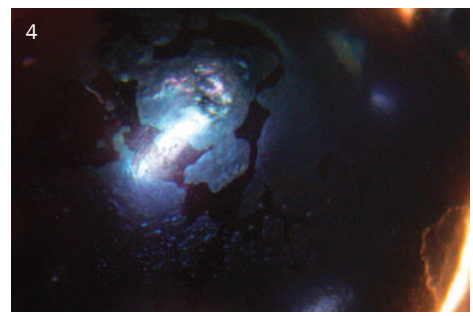
We have contacted both the supplier and the retailer as to the improper labelling. There has been no resolution as yet.

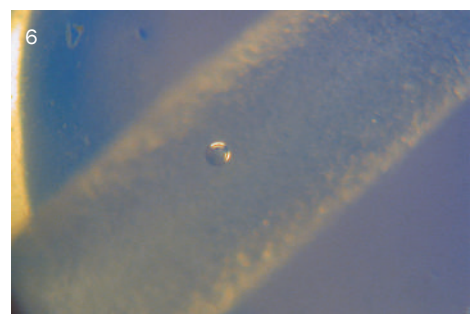
The fear of HPHT

In the past couple of years GIA's Gem Laboratory has seen several large colourless diamonds colour-enhanced using high pressure high temperature (HPHT) treatment. This has everyone who is buying large colourless diamonds on the alert; dealers are making certain every diamond gets a new grading report prior to purchase. However, this can be taken to the extreme, as the next case proves.

We recently saw a large, colourless, pear-shaped diamond of over 14 ct (**7**). The stone had two previous GIA diamond grading reports, one report dating back to the early 1970s. Even though the diamond had been graded E colour back then, the client wanted a new GIA report, just to make certain that the diamond had not been treated using HPHT. The use of HPHT in treating diamonds has only been in effect since the late 1990s; it would have been impossible to HPHT treat this diamond back in the early 1970s.

For more information about *The Roskin Gem News Report* visit www.roskingemnews.com.





3: Dyed Chinese freshwater cultured pearls, sold as AAA quality Tahitians.
4: Surface quality shows that layers of nacre are missing.
5: Plastic beads misleadingly labelled and sold as 'moonstone'.
6: A telling gas bubble in one of the plastic 'moonstone' beads.
7: The 14 ct E colour diamond.

Unusual inclusions

Tony de Goutière shares some of the startling photomicrographs he has taken of inclusions in gemstones.

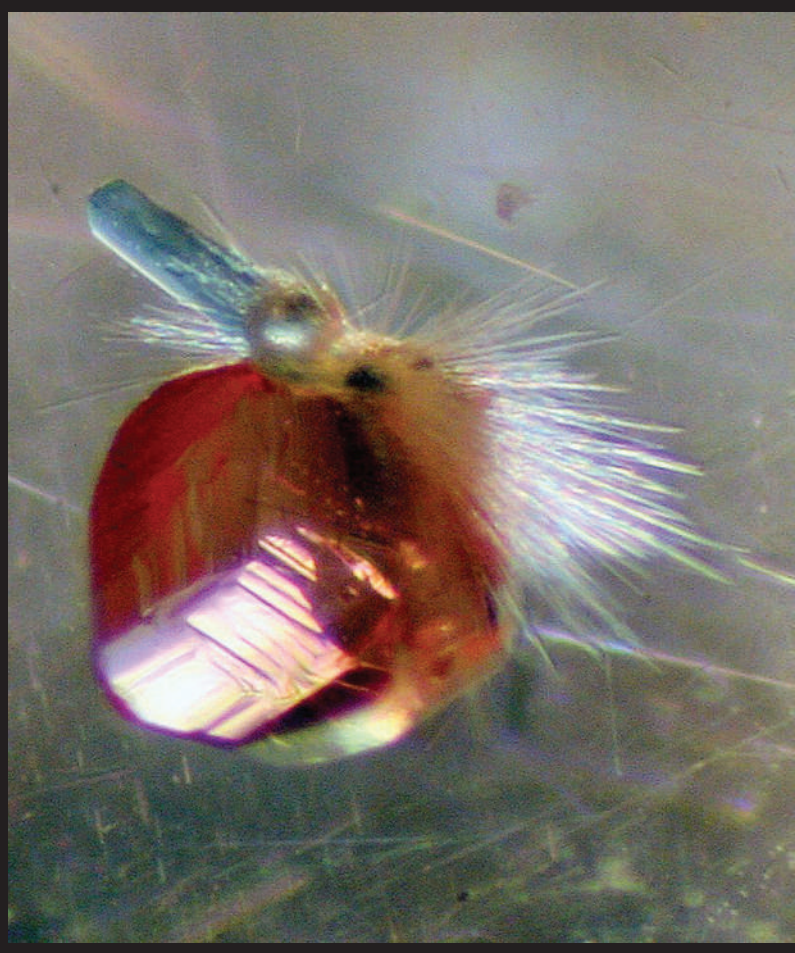
When examining specimens for inclusions, it's always a bonus having something unusual turn up in one's field of view. Here are some curious examples I have discovered in rose quartz, aquamarine, andalusite and quartz crystal.

The rose quartz specimen (**1**) had several very obvious garnet inclusions, but when I turned the specimen over I found this odd-looking little inclusion lurking just under a pavilion facet.

In the case of the rectangular aquamarine (**2**), the muscovite inclusions were visible but transparent so I used crossed polars to see if there was a reaction. There certainly was and I obtained these dramatic photomicrographs.

In the andalusite from Brazil (**3**) I was delighted to discover the world's smallest 'sundial' with a rutile needle providing the 'shadow'.

I almost discarded the small quartz fragment (**4**) but thought I'd better have a look at the dark areas and found the 'musket balls' ideally situated under and parallel to a smooth crystal face.



1. Rose Quartz

This 3.00 ct emerald-cut rose-quartz has several spessartine garnet inclusions scattered throughout but this particular inclusion is unique. Attached to the garnet are what appear to be a greenish-blue tourmaline crystal and a cluster of very fine asbestiform or rutile needles. There seems to be a gas bubble at the base of the tourmaline. The whole inclusion has the appearance of perhaps a child's toy, or an alien being floating in space. The specimen came from a mine in Kazakhstan.

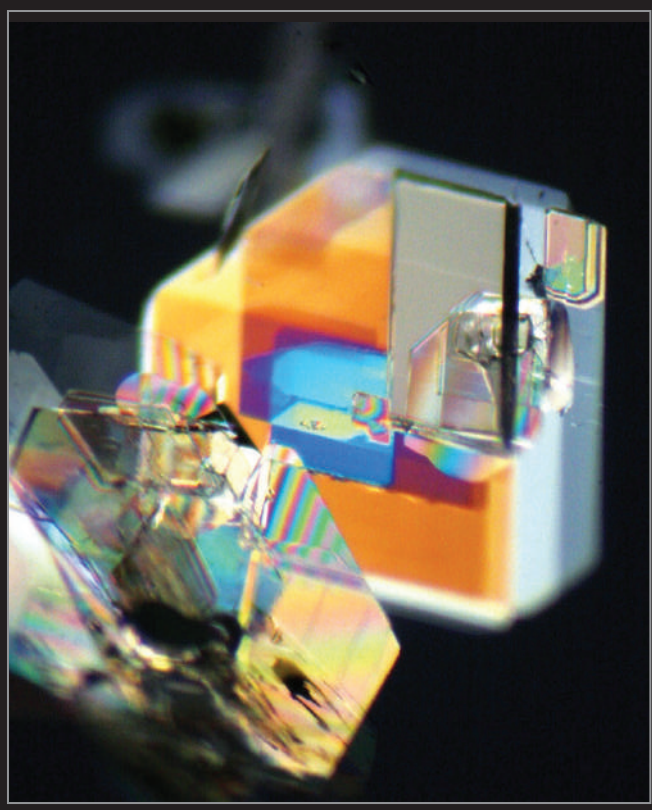
The field of view is approx. 1.5 x 1.8 mm. Transmitted plus oblique illumination.

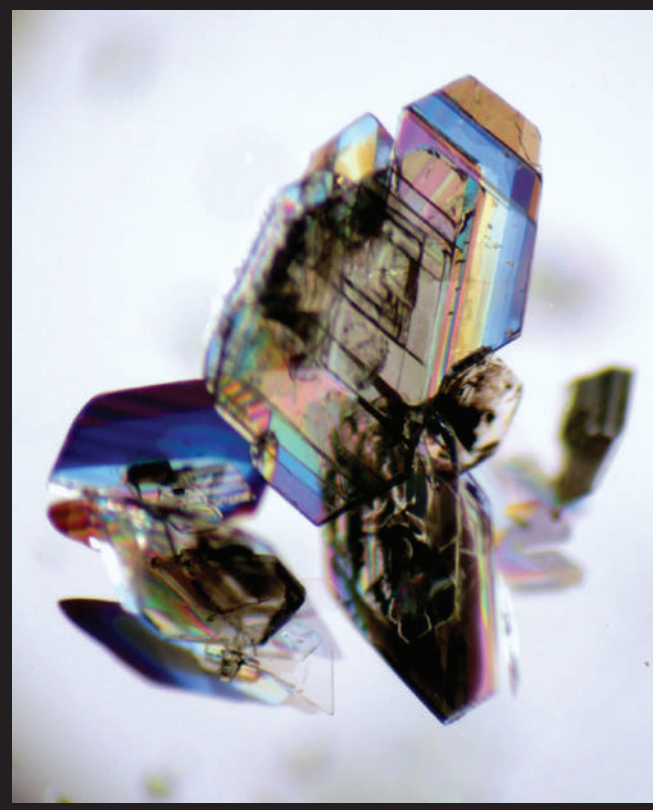
Through the Microscope

2. Aquamarine

This large 115.4 ct aquamarine has obviously been cut to display the wispy inclusions. One wonders if the cutter noticed the muscovite inclusions scattered about among the veils. These beautiful inclusions became obvious only when viewed through crossed polarizers.

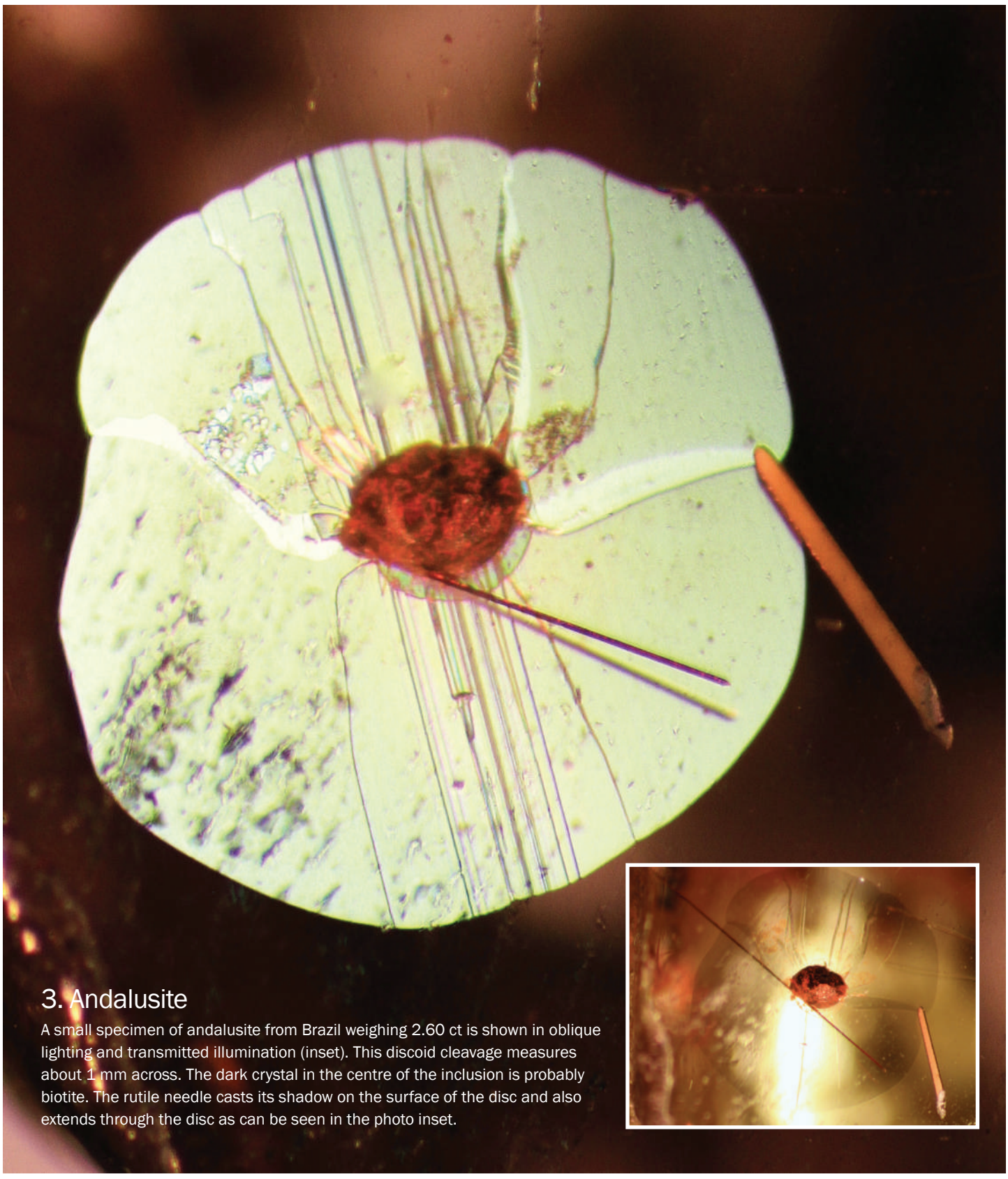
Field of view approx. 2 x 3 mm using transmitted polarized illumination (see also cover picture).





Through the Microscope

Unusual inclusions (cont.)



3. Andalusite

A small specimen of andalusite from Brazil weighing 2.60 ct is shown in oblique lighting and transmitted illumination (inset). This discoid cleavage measures about 1 mm across. The dark crystal in the centre of the inclusion is probably biotite. The rutile needle casts its shadow on the surface of the disc and also extends through the disc as can be seen in the photo inset.

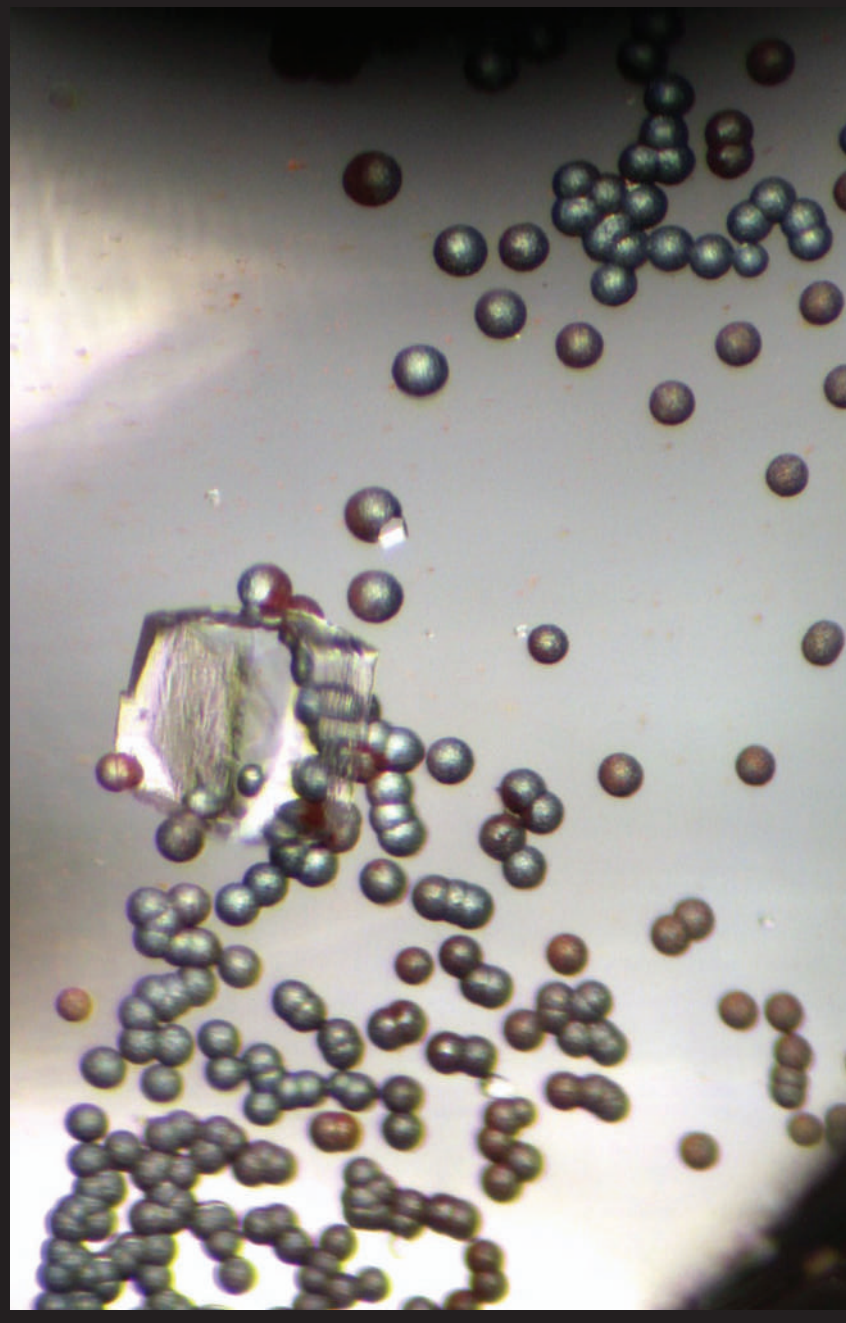
Through the Microscope

Unusual inclusions (cont.)

4. 'Musket balls and ice cubes'

A small fragment of a quartz crystal displayed a dark area which, when examined through the microscope, turned out to be a plane of tiny metallic-appearing spheres. Similar spheres have been identified as hematite (see *Photoatlas of inclusions in Gemstones* by Gubelin and Koivula, Volume 2, page 609). Also visible are three calcite or possible rock-salt inclusions.

Area photographed 2 x 2.75 mm, using transmitted plus oblique illumination.



All photomicrographs taken by Tony de Goutière with a Canon D7 SLR camera adapted to a trinocular Wetzlar microscope on an Eickhorst Gemmaster base. © Tony de Goutière.

About the Author

Anthony de Goutière GG (GIA) of Victoria, BC, Canada, has been specializing in gemstone photomicrography for many years. His photographs have been published in gemmological journals around the world and his photomicrographs have twice adorned the cover of *The Journal of Gemmology*.

Journal Files

The Journal of Gemmology

Summary of an article published in *The Journal of Gemmology*.

HPHT treatment: a history*

The use of high pressure high temperature (HPHT) treatment, sometimes combined with irradiation and annealing, can provide a wide range of diamond colours, from colourless to fancy. However, these processes also provide a challenge for gemmologists and laboratories.

The HPHT treatment of natural brown diamonds and synthetic diamonds produced by the HPHT process and Chemical Vapour Deposition (CVD) can alter their colour and transform them into a range of more marketable colours — a range extended by using HPHT treatment in combination with electron irradiation.

The history of the development of these processes can be understood best by surveying the relevant patents filed over the years. The story starts with the hint of possible colour change treatment for diamond found in two patents from General Electric in the 1960s. Patents issued by General Electric and De Beers in the late 1970s to early 1980s dealt more specifically with the colour alteration of type Ib natural and synthetic intense yellow diamonds by a process later confirmed to be an application of an HPHT treatment. The first patent to describe the improvement of brightness and colour tone of jewellery-quality diamond was filed in 1997, and in spring 1999 General Electric offered the first decoloured natural brown diamonds onto the market.

The patent applications, available as public documents and which are relevant to colour alteration of diamond, can be considered in three groups:

1. Colour improvement and alteration of intense yellow type Ib natural and synthetic diamond.

Several patents deal with colour improvement and colour alteration of type Ib diamonds containing predominantly isolated nitrogen atoms (C centres). Most synthetic diamonds grown by the HPHT process are of this type and reveal a greenish yellow or intense golden yellow to yellow, or even orange coloration. This coloration, which is sometimes too brown or dark for jewellery purposes, can be changed by HPHT treatment to a brighter yellow or towards a somewhat paler yellow or even approaching colourless. Although the same process is also described for natural diamonds, type Ib natural 'fancy yellow' diamonds are very rare and thus unlikely to be treated.

A patent application by Sumitomo Electric describes electron irradiation to type Ib synthetic diamonds prior to HPHT treatment which produced a green colour.

* A Summary of 'High pressure high temperature treatment of diamonds — a review of the patent literature from five decades (1960–2009)' by Dr Karl Schmetzer, *The Journal of Gemmology*, 2010, **32**(1–4), 52–65

Journal Files

2. Colour improvement and alteration of type I and type II natural brown diamond.

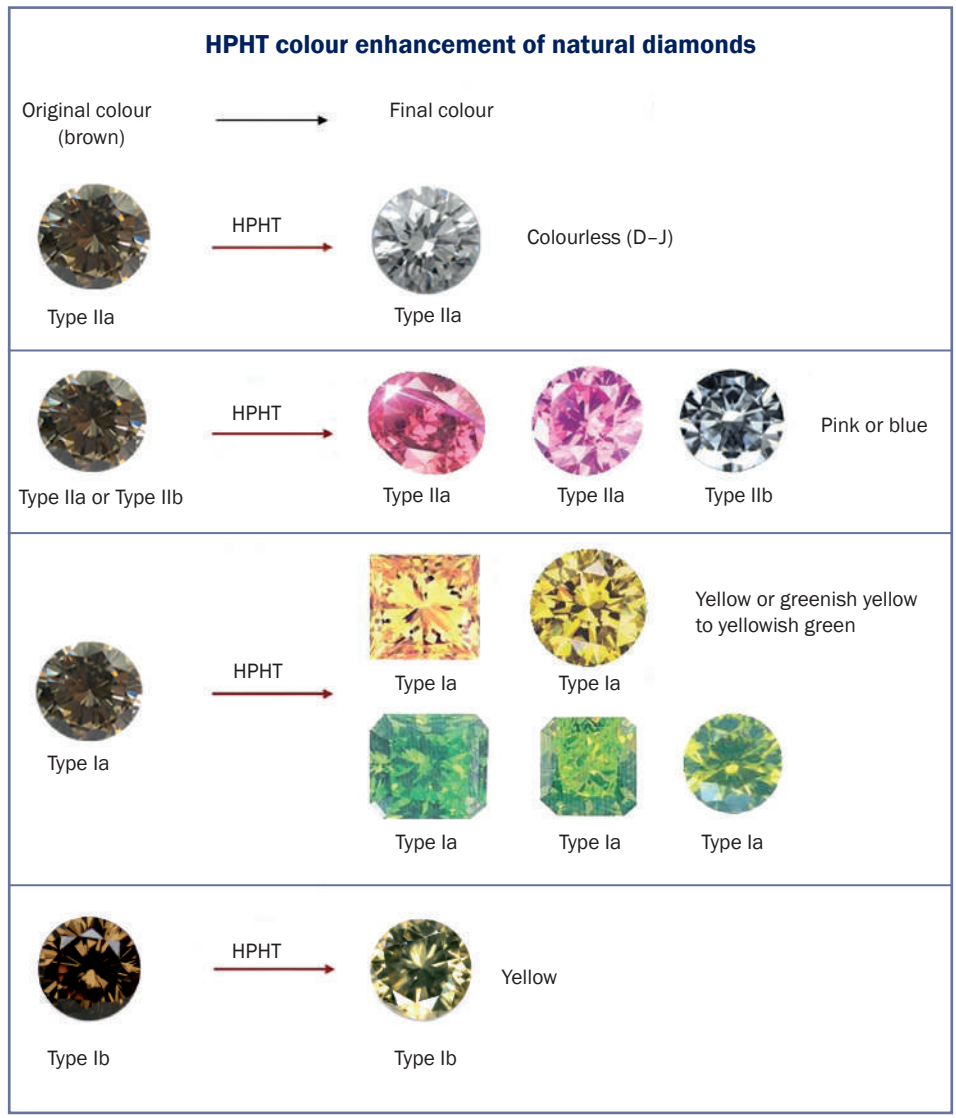
In nitrogen-free type II and almost nitrogen-free type I natural diamonds, the removal of brown colour centres results in colourless or almost colourless diamonds. If pink colour centres or their precursors are present in the untreated material, but hidden by the brown coloration, HPHT treatment produces a desirable pink colour. A similar mechanism applies to brown, brownish grey, grey or olive green diamonds with boron contents (type IIb diamonds). Here HPHT treatment removes the brown colour centres to produce blue to pale blue coloration.

Brown nitrogen-bearing natural diamonds can contain a range of colour centres. If only N3 and N2 colour centres are present, HPHT treatment produces a pale to intense yellow coloration. Formation of intense pink to red diamonds are by a three-step treatment process.

With natural type Ia colourless to brown diamonds, HPHT treatment followed by electron irradiation and a subsequent annealing results in a range of colours varying between violet, purple red, red, orange red and orange. A four-step process can be applied to synthetic type Ib diamonds: irradiation, HPHT treatment, second irradiation and annealing, can produce a great variety of colours.

3. Colour improvement and alteration of yellow to brown synthetic diamond grown by CVD.

As-grown CVD synthetic diamond may be brown, orange brown, pinkish brown or yellow; HPHT treatment removes the defects which are at least partly different from the major defects found in natural and synthetic HPHT-grown diamonds and results in colourless, near colourless, pale brown, green or pinkish brown diamonds.



Systematic overview of possible colour alteration by HPHT treatment of natural brown type I and II diamonds. This diagram is based on a somewhat smaller schema by V. Vins, Institute of Single Crystals, Novosibirsk, Russia, which has been extended by the present author.

The information provided in some of the patents allows us to understand the historical development of HPHT diamond treatment over the years, and also provides the necessary technical detail to better research the means of characterization and detection of those diamonds so treated. **J.O.**

The web-based version of the article includes an explanation of the different types of patent documents. The most relevant technical descriptions of a range of equipment used to perform HPHT treatment of diamonds are also summarized in appendices.

Recent Events

Cutting it fine

Master gem cutter Ken Harrington talks about hand cutting gems in a modern world.

On 15 February a crowded audience of Gem-A members and students listened to Ken Harrington talk about his craft and passion: gem cutting. Ken began his 50 years in the gem cutting trade as an apprentice to Charles Mathews Lapidaries, developing his expertise in 'improving stones' and cutting from rough. In his talk Ken covered various aspects of the traditional hand cutting of gems, how it differs from the modern, more mechanized cutting, and explained how the skills of an experienced coloured gemstone cutter can be used to improve stones during cutting, such as closing surface-reaching fissures.

Maximizing value when cutting from rough or improving the appearance of a gem by skilful re-cutting can be done in two basic ways. The first is to polish a gem in such a way so as to physically or optically maximize its colour, clarity or both. This can be done by cutting it to reorient it relative to its optic axes, by cutting to remove poorer coloured or included regions, or by cutting so that optically the colour or clarity appears better. For example, Ken explained how a sapphire with a localized concentration of blue colour in one region may be cut to appear fully blue, whereas if cut in another orientation it may look like a white sapphire. This was a skill long used by sapphire cutters in Sri Lanka. Ken described how he had recut a rather murky tanzanite to provide a most vividly coloured stone. The most startling example cited by Ken was an 18 ct ruby with an unattractive brownish tint that was unsaleable at the asking price. He repolished this and although it was reduced to just 14 ct, it was now pigeon blood colour and eventually sold for considerably more than the previously asked price. As far as adjusting optics were concerned, Ken described how repolishing an emerald to give it a slightly convex table facet, which he described as 'tallow-cut' (an old term meaning cabochon), changed the path of light and the reflections in the stone so that four previously prominent dark specks under the table 'disappeared', much to the astonishment of the dealer who owned the stone. As these examples demonstrated, and as Ken repeatedly stressed, weight yield alone is not always the best criterion for cutting rough — a skilful cutter will aim to get the best-looking and thus most valuable stone from rough, not necessarily the largest. There were many cases, he said, where the well-planned and skilful cutting of one stone from a parcel of rough gems would pay for the entire parcel.

The second way in which a stone can be improved or repaired was by making use of what is known as the Beilby layer. This still much-debated effect was noted by the Scottish scientist George Beilby just over a century ago. Beilby noted that in metals a thin and seemingly amorphous layer was produced over the surface during polishing. Whether this layer was caused by liquid flow of the metal due to the heat generated in polishing or was some other form of transport remains uncertain. The presence

A chance during the meeting to examine some of the stones cut by Ken. Photo by Jack Ogden.

Recent Events

of a similar layer generated on gemstones during polishing had also been postulated and this had generated controversy (see Crowcroft, 1981). Nevertheless, a young Ken Harrington turned to Basil Anderson and Alec Farn at what was then the London Chamber of Commerce's Diamond, Pearl and Precious Stone Laboratory for an explanation, when he wanted to understand an effect he was making use of on a daily basis in his cutting — with a meticulously smooth lap (polishing wheel) and the right abrasive, he could make the surface of a gem flow, thus filling in surface-reaching fissures and even reshaping problematic areas, such as damaged corners. Although theoretical gemmologists and scientists might express doubts about the nature or even existence of the Beilby layer in gems, Ken's work demonstrated that it or something similar existed and could be exploited to create smooth, high gloss surfaces on gems. This probably relates to old literature on the polishing of sapphire and other corundum from Sri Lanka which says that tin oxide was the most effective polish, even though it is significantly softer than corundum — so the polishing must be by some form of surface flow rather than abrasion.

Ken gave several examples of his exploitation of the presumed Beilby layer for both crystalline and cryptocrystalline gem materials, from repairing a fissure right across the table of a fine ruby — he showed before and after photographs — to the production of thin, high gloss stone watch faces in the 1970s for English manufacturers such as Roy King. This repairing of gems had also been noted by other traditionally skilled gem cutters. Ken later commented that the owners of the gems he had 'repaired' sometimes complained that he must have swapped stones, although however generous a man he might be, removing a non-perfect stone and replacing with one of greater value seemed an unlikely act.

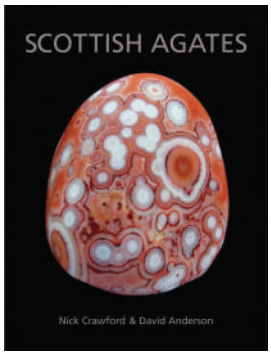
Ken's talk was a perfect demonstration of the importance of hands-on craft skills and experience in gemmology, that practical workers had so much to tell theorists, and that modern hi-tech machine cutting does not necessarily produce the best yield from rough in either appearance or value terms.

Reference

P. J. Crowcroft, 1981. Demise of the Beilby-Bowden theory of polishing. *The Journal of Gemmology*, **17**(7), 459-465

Book Shelf

Scottish Agates



Nick Crawford and David Anderson, 2010. Lapidary Stone Publications, Corsham, Wiltshire.
Paperback, 210 pp. Full-colour photographs.
ISBN 978-0-9558106-1-9
Price £14.99

This illustrated book brings together detailed information about Scottish agates, including their formation, location and the history surrounding their collection, as well as a review of the latest theories on agate genesis. It is aimed at those interested in natural history, in the geological record of Scotland and in agate collecting. Nick Crawford and David Anderson have lavishly illustrated the book with photographs, drawing on the breadth of colours and patterns found in Scottish agates.

Divided into 17 chapters, the book begins with a short introduction and definitions, and moves onto the geology of Scotland, concentrating on the origins and distribution of the agate-bearing volcanic rocks in Scotland. The text is not too technical, and potentially difficult terms and concepts are explained to give a free-flowing concise script. The 'accessible' text has, however, resulted in oversimplification, and minor inaccuracies are introduced. Nevertheless, the reader can enjoy the geological history with confidence.

The hotly debated topic of agate genesis forms the basis of Chapter 3. This has sections dealing with microstructures, colour and formation process, as well as a section with the understated title 'Some uncertainties in agate formation'. The conclusions that form the last part of this chapter draw together current thinking on agate formation. The authors lean towards the view that there is no single unifying theory of formation, and liken agate formation to that of zeolites which form at different temperatures and in different geological environments. Additionally, they cite variation in the infilling of vesicles in close proximity and the pseudomorphing of organic matter by agate in support of a complex multi-formational origin.

'The History of Agate Collecting in Scotland' (Chapter 4) is well researched and contains many quotations from collectors and recorders of the times. One notable omission is that of the Deuchar family who, shortly after 1745, left Montrose for the port of Leith, Edinburgh, with barrels of agates to set up a seal engraving business using Scottish agates.

The 'meat' of the book is contained in Chapters 5 to 13. These detail the agate-bearing locations in Scotland, making an excellent travel guide for collectors. The text style, with information such as "a popular destination", "adjacent to the world-class Turnberry golf course" or "ideal for getting away from it all", reinforces this agate-collecting travel guide approach. The information is comprehensive and includes the locations of the best material, descriptions of the agates, and their quality and size. Each locality described has supporting good-quality images of the sort of agates found at the site, covering the historically important areas and currently productive sites, including the east coast, the west coast, the Cheviots, the Scottish Islands and other less productive sites around Scotland, from Dumfries and Galloway to Banffshire. Information relating to access and collecting is often given — particularly when not allowed or restricted. The authors have been careful to select images not only of classic agate structures, but also of the unusual and less common, so that the reader gets a view of the breadth of material available, such as whorled agate and agatized fossil coral.

No book on Scottish agates should ignore their contribution to fashion, and indeed a section deals with artefacts made from Scottish agates. Some early contributions are omitted, particularly the impact made by the previously mentioned Deuchar family, Napoleon's Continental blockade (1806—1814) which restricted imports of agates from Germany and stimulated the use of indigenous material, and the contribution of Gavin Young, whose mass-production water-powered lapping machinery allowed cheaper and greater amounts of material to be produced (1846).

In keeping with a current trend, agate collectors are profiled. Chapter 16 turns the spotlight on collectors not featured in other publications and this is to be welcomed. A very useful bibliography is provided and the index is comprehensive.

This book is incredibly good value for money. It goes way beyond Harry MacPherson's book on agates (1989), which is now difficult to find. The breadth and detail truly focus on Scottish agates and in as much as Heddle's *Mineralogy of Scotland* (1901) is the 'bible' for collectors of Scottish minerals this book will be the agate collectors' bible for Scottish agates. The authors are to be commended and I heartily recommend it.

Brian Jackson

Book Shelf

Zeitgeist: A Century of Idar-Oberstein Costume Jewellery

Wilhelm Lindemann (Ed.), Anne-Barbara Knerr, 2009.
Arnoldsche Verlagsanstalt GmbH, Stuttgart.
Hardback, 192 pp, approx. 270 colour illustrations.
Text in English and German.
ISBN: 978-3-89790-314-2
Price £45

Idar-Oberstein in Germany is well known as a centre for trading and manufacturing precious and semi-precious gemstones. However, it also produced high class costume jewellery, using brass, tombac and anodized aluminium, from the latter half of the nineteenth century until the early 1980s. Most of the cutting and polishing mills were situated in Idar along the river Idarbach and made use of its water power, while most jewellery manufacturers were located in Oberstein along the river Nahe.

Although fashion jewellery was prevalent throughout the twentieth century, it has not been subjected much to the rigours of art-historical study. In this book, art historian Anne-Barbara Knerr provides a comprehensive scholarly overview of the production of costume jewellery, ranging from watch chains — made in Oberstein as early as 1826 and often set with agates or glass beads — through to necklaces and fashionable accessories such as toiletry sets, evening bags and powder compacts. It is also made clear that costume jewellery design did not simply copy and replicate *haute jouaillerie*, rather it emerged from a reflection and evaluation of the prevailing trends in art and design and created its own distinctive artistic concepts, from Art Nouveau and Art Déco to Art Informel and Zero.

The museum in Idar-Oberstein has some handsome pieces of Art Nouveau jewellery, particularly an interesting range of chatelaines. In the 1920s–1930s there was a 'flowering' of the industry with beautiful Art Deco designs. Necklaces were sometimes lacquered in different designs on front and back, making them reversible. After the Second World War a number of manufacturers tried to revive the industry and for a few years produced some attractive goods.

The book also features descriptions and histories of the twelve most important Idar-Oberstein companies and their owners, along with illustrations of some of their best pieces. Also included is a useful glossary of technical terms.

Zeitgeist — A Century of Idar-Oberstein Costume Jewellery is a lavishly illustrated and scholarly book which creates a vivid picture of the inventiveness of a sector that vanished thirty years ago. A book for jewellery lovers and collectors alike who are eager to explore uncharted terrain in jewellery.

Evelyne Stern

GemExplorer iPhone App

SSEF Swiss Gemmological Institute, 2011.
iPhone App, developed with jibbapp.com.
See the Apple App Store on iTunes.
Price £Free

There is a brand new App for gem fans, gemmologists and, presumably, gem miners, called GemExplorer, released in early 2011 by SSEF. The App uses the iPhone's inbuilt compass feature to show the location of gemstone mines in relation to the user's location with compass arrows.

The App sports a slick and attractive design, including a pleasant animation when the arrows appear, showing the directions of the various mines. The arrows themselves, whilst restricted in size by the dimensions of the screen itself, appear on a delightful antique-looking compass illustration. Similar to the iPhone's own compass, the arrows move with the user — akin to a real compass — depending on where North is. A tap on one of the arrows brings up the location of the mine as well as the main gems mined there. There is also a handy feature where you can view all mines on the compass, or view by gemstone. Dr Michael S. Krzemnicki, director of SSEF, said: "We have developed this for those with an interest in gemstones and their sources, pursuing our mission to share gemmological knowledge since 1974."

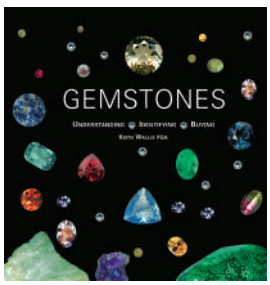
Whilst interesting and educational, the App could do with a few more facts about the gemstones mentioned, such as information concerning the history of the gemstone (for example, when it was first discovered, how it is formed etc). Viewing all mines renders the compass face somewhat crowded, which in turn makes each arrow difficult to tap on. Perhaps a zoom feature or a list of all mines would help with this. Some mines, whilst famous for one particular production, also produce other gemstones and further details of these would be interesting. However, this being said, gemmology is a subject of great depth and breadth, and therefore no single application, reference, or book could ever possibly tell a true gemstone enthusiast the whole story.

All in all a good, fun App for gemmologists both on the move and at home. The App is free and can be found via Apple's App Store on iTunes.

Fiona Eastmond

Book Shelf

Gemstones: Understanding, Identifying, Buying



Keith Wallis, 2006. Antique Collectors' Club Ltd, Woodbridge, Suffolk. New edition, hardback, 160pp, 300 colour illustrations.
ISBN: 978-1-85149-630-3
Price £14.95

An interesting and well-presented book, Keith Wallis's *Gemstones* sets out to bring the reader into the world of gemmology without becoming overly technical, or relying on tables of figures to convey information. Targeted mainly at the layperson to intermediate gemmologist, this book would also be useful to any gemmology student, as it provides a clear, concise, and colourful guide to many of the gemstones seen on the market today. Illustrated throughout with clear, full colour photographs on every page, this work covers over 100 different gemstones, giving brief identification notes, details of possible treatments, and simulants of each, with historical information on the vast majority of gemstones that the typical reader will encounter, either on the high street or through trade shows.

Split into eight sections, the reader is first introduced to the basic tools of the trade and the testing methods used by gemmologists, before exploring the history and stories behind various gems from biblical times up to the modern era. The main sections cover diamonds, gemstones, and organic gems (amber, pearl, etc), in sufficient detail to pique the interest and to keep the reader's attention. Diamonds are given their own chapter — as befits them — and are dealt with in all aspects, from identification through to colour and clarity grading. Also included is information on the ways in which they may be imitated. All of the usual and 'common' gemstones are covered, along with some rare (or collectors') stones, with notes on those that can be synthesized, and those which are currently viable. This is followed by details of organic materials, including their growth origins and, again, their imitations.

Of particular note in the later chapters is the section on 'Gemstones Around The World', which provides a summary of notable gem localities in such a way that it can be easily referenced by country, with the gemstones section allowing any specific gem to be cross-referenced to the various sources. At the end of the eight main sections are a set of appendices that provide easy-to-read information on a variety of subjects, from colours, refractive indices and specific gravities through to relative values, all of which are provided in readable formats. This section also includes a table of tanzanite values, which is not common to many texts.

Many a student to intermediate gemmologist will find this a useful text, but for the more experienced/advanced reader, the lack of technical data may limit the extent to which the book can be used.

Andrew S. Fellows

Gem-A Photographic Competition 2011

This popular competition is back!

Because digital photography was becoming prevalent and the possibilities of computer manipulation of images were creating anything but a level playing field for entrants, it was decided in 2006 to put the Gem-A Photographic Competition on hold. The competition has now been reintroduced embracing and celebrating these new technologies.

There are four catagories under which an image may be submitted:

1 **Natural**
Digital photograph (including photomicrography) with minimal post-production work (may include basic cropping, contrast and minor hue/saturation adjustments).

2 **Treated**
Digital photograph (including photomicrography) with significant post-production work (such as background manipulation, HDR, and contrast masking).

3 **Synthetic**
Computer-rendered 3D models of gemstones, crystals, crystal structures, images from microtomography, etc.

4 **Melange**
This category includes any gem-related image that doesn't fit in the above and may include such things as photos of a spectrum, a scanning electron microscope image, mining, cutting, etc.

To enter

An entry form and full details of the competition, including copyright information, can be accessed at www.gem-a.com/membership/photographic-competition.aspx or call Carlos on +44 (0)20 7404 3334.

Closing date: 31 May 2011

Gem-A
THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

UK registered charity no. 1109555

Photos: Winners of past Gem-A Photographic Competitions. (Top) Limonite framework in topaz by Alan Hodgkinson FGA DGA (2004) and (below) lepidocrocite inclusions in quartz by Luella Dykhuis FGA DGA (2005).

Museum News

Afghanistan: Crossroads of the Ancient World

Goldwork and other treasures from ancient Afghanistan have come for the first time to the British Museum.

One of a pair of pendants depicting the 'Dragon Master' made from gold, turquoise, garnet, lapis lazuli, carnelian, and pearl. Tillya Tepe, Tomb II, first century BC–first century AD. National Museum of Afghanistan.
© Thierry Ollivier / Musee Guimet.

The decree by the Taliban Chief Mullah Omar in 2000 triggered what was supposed to be the destruction of all non-Islamic art and tombs in Afghanistan, the horrendous results of which are well known. Among the victims were assumed to be the amazing 2000 year old gold jewellery from Tillia Tepe, as well as several other Afghan treasures. The gold hoard from Tillia Tepe (a necropolis in northern Afghanistan near the Turkmenistan border), was excavated by a joint Russian-Afghan expedition in 1978, and brought to light a second time in 2004 when it was revealed that it had been prevented from being melted down by the extraordinarily courageous act of concealing it in the vaults of the Central Bank of Afghanistan. Nothing was missing.

The exhibition

The Tillia Tepe gold was first made known to the world at large in a magnificent volume entitled *Bactrian Gold: From the Excavations of the Tillya-Tepe Necropolis in Northern Afghanistan* by Victor Sarianidi (Aurora Art Publishers, 1985). In 2006 the Tillia Tepe Hoard, along with other ancient Afghani treasures, was exhibited for the first time outside Afghanistan at the Musée Guimet, Paris (6 December 2006 to 30 April 2007). Other exhibitions followed in Italy, The Netherlands, USA and Canada, and now it has reached the UK.

I was lucky to be able to see the original exhibition in Paris and study the objects in some detail for a review of the exhibition for the *American Journal of Archaeology*. What follows is a brief note, primarily on the gem materials, based on that far longer review which is still available on the web.[1] There is a lavish, well illustrated, catalogue for the London exhibition, largely, but not entirely, mirroring that produced for the Paris Show.[2] One section from the Paris catalogue that didn't make it to the English version is that which might be of most interest to gemmologists; the appendix on the analysis of the gold and gems, with comment on possible sources. The inlays were examined with standard gemmological instruments, which means that the descriptions of the gem materials in the catalogues can probably be taken as accurate — something that cannot always be taken for granted in such exhibitions. Gem materials identified in the collection include amber, amethyst, chalcedony, garnet, hematite, lapis lazuli, nephrite jade, pearl and pyrite.

There are treasures from four Afghanistan sites in the exhibition: Tepe Fullol, Aï Khanoum,Tillia Tepe and Begram. These range in date from before 2000 BC to the early centuries AD.

Tillia Tepe

The Tillia Tepe goldwork — encompassing more than 20,000 gold ornaments found in six burial mounds — dates back some 2000 years. In technique, and to a lesser extent style, the jewellery demonstrated antecedents in Persia and the classical world, but the range of gem materials is in stark contrast to Roman work of the same period. A ring from Tomb 2, of large finger size, is set with a flat oval turquoise intaglio — a stone seldom seen in Hellenistic Greek or Roman jewellery. The intaglio carving depicts the Greek Goddess Athena, but in a distinctly eastern style. The turquoise, of which there is much in the exhibition, must have come from the Iranian mines near Mashhad or from Afghanistan itself. Another ring from Tomb 2 is set with garnet, turquoise, amethyst and lapis lazuli. Turquoise inlays are abundant in the show and many are in one of two forms — a heart shape and a curved tear-drop shape. The heart-shaped turquoises could be straight from a Valentine's Day card, but do compare with the heart-shaped garnets we see in some later Hellenistic Greek jewellery.

Other gem materials

A small figure of a lion from Tomb 5 described as 'amber' has a rather shiny surface; if it really is amber it may have been consolidated in some way in recent times — ancient amber is usually friable in the extreme. Also from Tomb 5 is a malachite intaglio set in a silver ring. However, although the intaglio depicts a Roman-style representation of the goddess Victory, malachite is almost unknown in Roman jewellery from the European and Mediterranean world. Several gold objects are also set with pyrite — this is sometimes seen in jewellery from further west, but is not common there. An intaglio from Tomb 3 depicting a bull in a simple, globular engraving style is formed of nephrite.

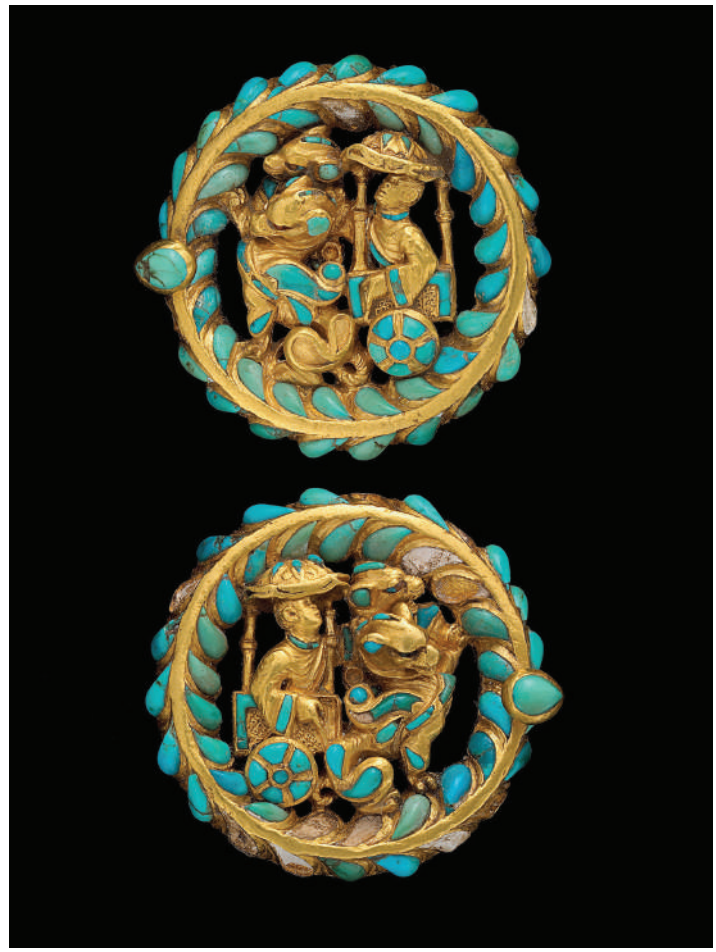
The Tillia Tepe jewellery may be well known to many from its previous publication, but seeing them in the flesh allows us to see the large size of many of the gold ornaments — a contrast to Greek gold which is often so much smaller in the flesh than we imagine from photographs (or from the ubiquitous forgeries).

Crystal cup

The magnificent finds from Begram, some 50 miles north of Kabul, might not include goldwork, but many gemmologists will be rendered speechless by a large rock crystal cup, to my mind the star of the exhibition. This extraordinary object is a roughly hemispherical bowl, carved from a single piece of rock crystal some 14.5 cm in diameter, not including the two large handles (all part of the same piece). The walls are just a couple of millimetres or so thick, and engraved and partly inlaid. A true masterpiece of lapidary work.

Hope for the future

I ended my review of the Paris Exhibition, written in 2007, with the wish that Afghanistan would have entered a period of peace by the time the National Museum in Kabul celebrated its centenary in 2009. Sadly, peace still seems a long way off in the troubled country that has been a crossroads of the gem trade, culture, art, and religious beliefs since long before Alexander the Great passed by some 2300 years ago.



Gold, turquoise, and carnelian boot buckles depicting a chariot drawn by dragons (Tillya Tepe, Tomb IV), first century BC — first century AD. National Museum of Afghanistan. © Thierry Ollivier / Musee Guimet.

Jack Ogden

References

1. www.ajaonline.org/pdfs/111.3/AJA1113_Ogden.pdf
2. *Afghanistan: Crossroads of the Ancient World.* Edited by F. Hiebert and P. Cambon, British Museum Press, London. 2011. See also http://www.guimet.fr/IMG/pdf/dossier_de_presse_afghanistan.pdf.

Afghanistan: Crossroads of the Ancient World is exhibiting at the British Museum, London, until 3 July 2011.

Stone Scoop

Blue and white

Jack Ogden discusses sapphire, and the attraction of white sapphire over diamond.

Royal sapphire

The selling power of the word 'Kashmir' in the description of a sapphire is not a recent thing. On 15 December 1933 the London auctioneers Christie's auctioned "an important Kashmir sapphire, a present from the Tsar Alexander II, to his daughter, the Grand Duchess Olga who married the King of Würtemberg" (auction notice in *The Times,* 4 December 1933). The Grand Duchess Olga (Nicolaievna) married the Crown Prince, later king, of Würtemberg in 1846 but was actually the daughter of Emperor Nicholas I (died 1855), not Alexander II. Even if it was Alexander II who gave it to his sister the Grand Duchess Olga, there is something wrong with the historical or geographical attribution — Alexander II was assassinated in 1881, the year before sapphires were first discovered in Kashmir.

White weddings

Although blue sapphire has always been the best known of the corundum gems, a century ago white sapphires were an honourable and admired alternative to diamond. White sapphire jewellery was commonly noted in reports of London society weddings, being worn by the guests or given as gifts to the bride. In 1906 the New York Sun reported that in British Society "Pearls rank first as the favourite stone ... and moonstone, white coral and white sapphire are also fashionable."

This is not to say that white sapphires were any less favoured in America. For example, in 1897 the *Kansas City Journal* had commented that "Some of the most beautiful gems in the world are the white sapphires of Ceylon". A few years later, by which time Montana white sapphires were well known, another American writer commented that although rock crystal produced fine stones these were not to be confused with "the diamond, the white sapphire or the 'tear' topaz." In 1903 a US newspaper noted that "the white sapphire sheds such brilliancy by artificial light that it requires an expert to distinguish it from a diamond." Perhaps predictably, the Montana white sapphires were often called 'Montana diamonds'.

The difficulty in distinguishing white sapphire from diamond was made much of in marketing. Thus in 1910 the Provident Gem Co. of New York were selling a '1 carat Tiffany set' ring, set with a white sapphire, for $8, noting that "White sapphire very often deceives experts and pawnbrokers, which is good proof stones cannot be detected from diamonds when worn."

Little white lies

Inevitably there were cases where fraud was intended, such as one reported in the *London Times* in November 1902 when a dealer borrowed a diamond ring from another dealer supposedly to show a client, but then swapped the diamond for a white sapphire. The heating of blue sapphires to make them colourless so as to imitate diamonds was a centuries' old practice. For example, in 1652 Thomas Nichols had noted that sapphires could "be converted into very excellent Diamonds".

There were even fakes of white sapphires — the ultimate proof of their importance. A century ago many advertisements referred to "genuine white sapphires", hinting that not all were — indeed synthetic white sapphires could be produced, although the extent of the market then is unknown. Certainly by 1857 Gaudin had produced synthetic white sapphire "of sufficient size to be used as jewels in watches". A century earlier, in 1748, John Hill had explained that white sapphires are "very beautiful, extremely bright, and of a fine Water, far exceeding any other Stone except the Diamond." He then went on to complain that jewellers were "selling Crystals well cut under the Name of the white Sapphire, and have debased the Value of the Stone". By 'crystals' he may have meant rock crystal or possibly even colourless glass paste.

White price

The value of white sapphire is unclear. The advert for an $8 ring set with a one carat white sapphire gives us a guide, but other reports are confusing. In 1902 one report said that the white sapphires found in Yogo district, Montana, "stand all tests of diamonds, for brilliance and hardness, and are almost as valuable, selling in the markets of London and New York at $35 a carat ordinarily". Another 1902 report said: "The stone that is creating the furore is a white sapphire, very hard, but of comparatively little worth."

Colour change

But, as noted at the outset of this article, blue sapphires were the most highly favoured of the sapphires. Predictably, the *Shenandoah Herald* for 30 September 1892 tells us that "White sapphires are made to look like blue and thus multiplied many fold in value by a mere touch of blue coloring on the point at the bottom of the stone ... The same effect is sometimes obtained by the use of a little blue enamel in the setting".

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