Gems&Jewellery

April 2009 / Volume 18 / No. 2

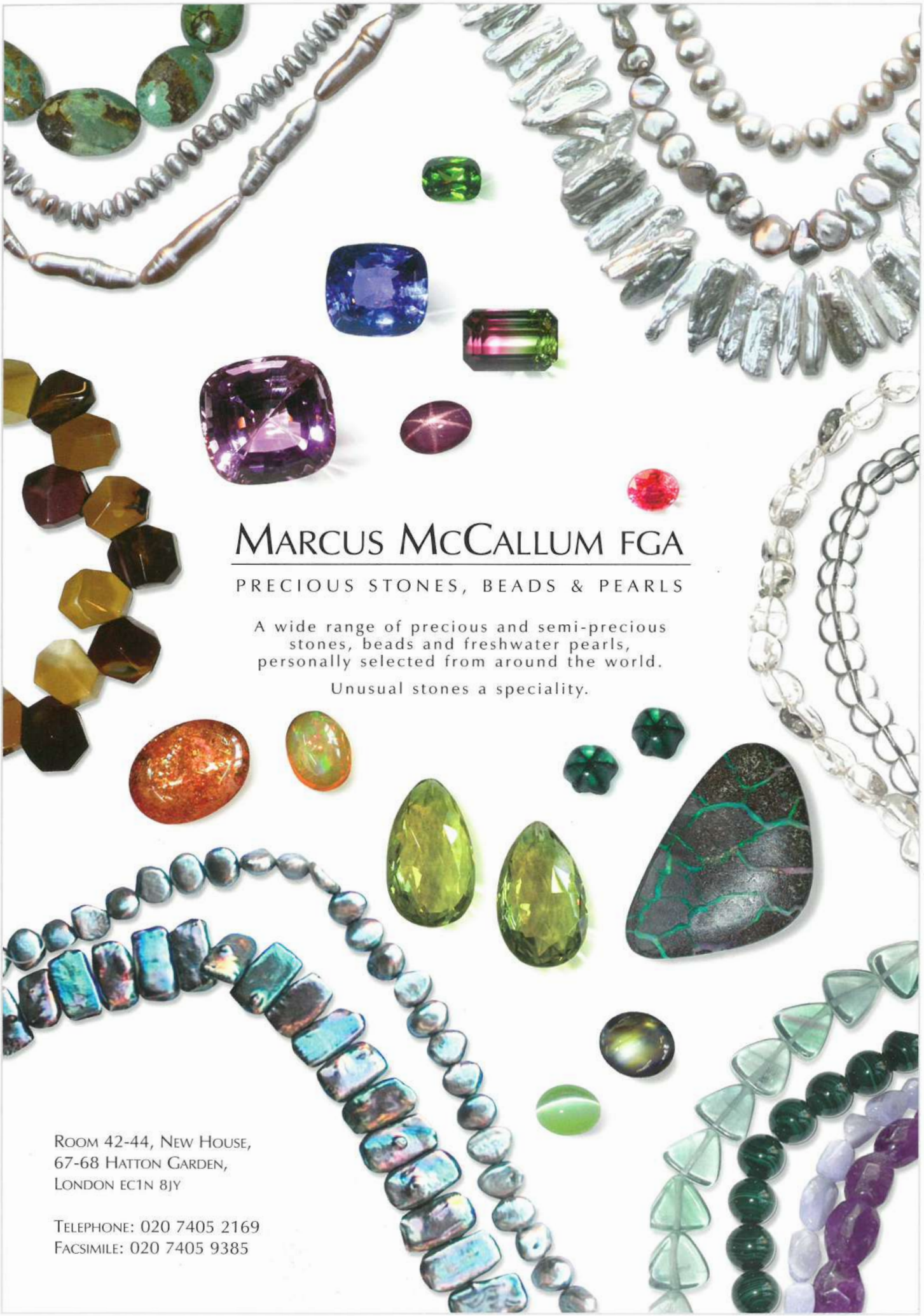
Durability, damage and disaster with gems

What to call synthetic diamonds

Morganite and pink quartz jewellery wins awards

Gambling for a diamond – The Pigot

The Gemmological Association of Great Britain



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Editorial

Gems&Jewellery

April 09

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Who needs gemmology?

That was a question I was asked recently. It wasn't meant to be rude, it was genuine question asked by someone from a totally different sphere. Who, she wondered, would benefit from learning about gems? I explained a bit about the subject, how gemmology education is primarily aimed at those in the gem and jewellery trades, where a mistake can cost a lot of money and, equally important, loss of reputation. I talked about the wide field, from the 'classical gemmology' using the basic equipment covered in our classes to the 'advanced gemmology' which is usually the preserve of well-funded labs.

The conversation was getting a bit science heavy, so I moved on to explain that gemmology is also fun, it brings together art, science and beauty, which is why there is an increasing number of hobbyists. Most hobbyists don't have access to a lab, so they have to get their kicks with basic equipment. There are still opportunities. I had an example to tell her. There is a brief review of the 'Treasures of the Black Death' exhibition on pages 34–36. I had gone back to that fine exhibition a second time, armed with a blue filter and green laser pointer. Under the guise of pointing things out to a student, I shone the narrow green beam through the glass of the show cases onto some of the red stones with the blue filter held to my eye. The rubies fluoresced a bright red, the garnets were inert. Not rocket science, but long-range gemmology of a sort, inspired by Harold Killingback's comments about the availability of green laser pointers on the Gem-A MailTalk email forum a few weeks ago. Tests showed it worked at ranges of four metres or more — try doing that with a pen torch and a Chelsea Colour Filter. There are always new things to experiment with, things that are fun to try. They might not necessarily change gemmology, but they make life interesting.

Finally I summed up. Those who want to play an active, responsible and profitable part in the gem and jewellery trades need gemmology education, as do those who are enthralled by the extraordinary beauty found in nature and the lengths men go to, for good or bad reasons, to imitate it. Are these so separate?

She asked: "Aren't those in the trade who take your courses also enthralled by the subject?" I had to admit that not all were, but those that get hooked and become enthusiasts are the true gemmologists.

Jack Ogden
Chief Executive Officer

Cover Picture
Two prize-winning entries from the AGTA Spectrum Awards at Tucson. Pink star rose quartz ring accented with pink sapphires and diamonds by Jennifer Rabe Morin of Jennifer Joalliers. Morganite briolette and diamond earrings by Judy Evans of Richard Krementz Gemstones. Photo courtesy of AGTA. Photography by Jack Deutsch. See Tucson 2009, page 16–17.

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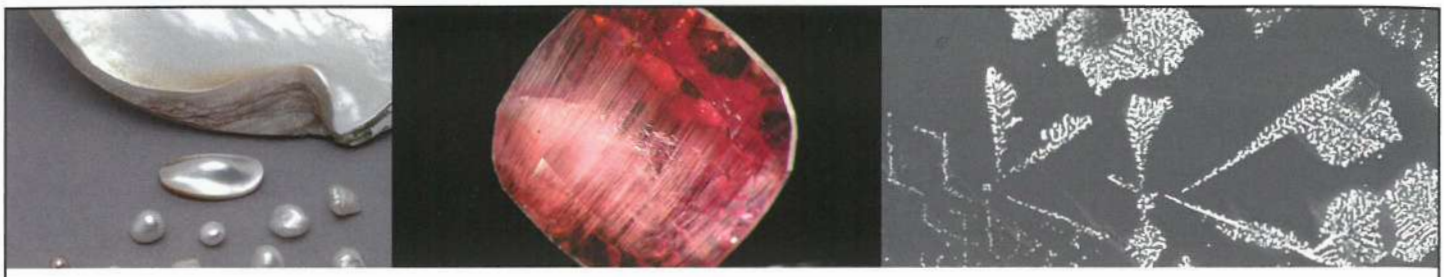


2009 EUROPEAN GEMMOLOGICAL SYMPOSIUM

Organized by the Swiss Gemmological Society SGG/SSG
Friday 5 June to Sunday 7 June 2009 – Berne, Switzerland

The Swiss Gemmological Society is proud to invite all interested gemmologists to the 2009 European Gemmological Symposium.

Programme: Speakers will present a range of topics on diamonds, coloured stones, pearls and the jewellery trade, highlighting both the history of gemmology and state-of-the-art gemmological research.

Speakers: *Sir Gabi Tolkowsky and Martin Rapaport (Keynote speakers). Walter Balmer, George Bosshart, Maggie Campbell Pedersen, Jean-Pierre Chalain, Dr Eric Erel, Thomas Hainschwang, Dr Vera Hammer, Prof. Dr Henry A. Hänni, Michael Hügi, Dr Stefanos Karampelas, Dr Michael S. Krzemnicki, Dr Claudio Milisenda, Helen Molesworth, Andy Müller, Dr Daniel Nyfeler, Dr Jack Ogden, Roland Schlüssel, Dr Karl Schmetzer and Dr Dietmar Schwarz*

Poster session: Details given at www.gemmologie.ch or email EGS.2009@gmail.com. Contributions welcome.

Additional events (participation optional):

- Welcome cocktail on the evening of Thursday 4 June and Symposium Dinner on Friday 5 June.
- A visit to the mineral collection of the Natural History Museum in Berne during the afternoon of Friday 5 June.
- An excursion to the famous crystal cave at Grimsel in the Swiss Alps on Sunday 7 June.

Symposium fee: The fee for the Symposium is 550 CHF. Included in the fee are: Welcome Cocktail on the evening of Thursday 4 June, lunches and Symposium dinner on Friday 5 June. Special students fee: 100 CHF (Friday and Saturday, excluding dinner)

EGS

Registration and hotel booking: For details on registration and how to book a hotel in Berne please visit www.bern-incoming.ch. For further questions, you may contact Doris C. Gerber, Tel. +41 41 429 15 80, doris.gerber@edigem.com.

Bead Stringing Workshops

Photo courtesy of Marcus McCallum

Due to the rapidly increasing popularity of bead necklaces, there is an amazing selection of beads of all shapes, sizes and colours now available for you to choose from. At the one-day Gem-A **Bead Stringing for Jewellery** workshop you can learn how to thread your beads and create your own unique necklaces. All materials needed to make your own creation will be provided.

Once you have learned the basic stringing techniques, or if you need to refresh your skills, the **Advanced Bead Stringing for Jewellery** workshop will give you an insight into the problems of multiple strands and graduated beads, as well as how to deal with more complicated designs. Participants will make and take home a double-row necklace.

Bead Stringing for Jewellery
Wednesday 6 May 2009

Advanced Bead Stringing for Jewellery
Thursday 7 May 2009

Price of each course: £156.50 (Students: £115.00)

Workshops are held at the Gem-A London headquarters from 10:00 am to 4:30 pm.

For further information or to book a place, email information@gem-a.com call +44 (0) 20 7404 3334 or visit www.gem-a.com

Durability, damage and distress

Professor Henry A. Hänni discusses how gemstone damage occurs and how to avoid it.* Durability is considered an essential property of gemstones. However, gems can exhibit many different types of damage, including that caused by accident or negligence. Such damage can often be avoided with care and a little knowledge. This same knowledge is useful when gemmologists are consulted by insurers about the causes or timing of damage. The trend towards repairing jewellery with the gems in place also provides new opportunities for damage.

Over many years working in the SSEF gemmological laboratory I have encountered numerous gemstones with old or more recent damage, always with the clients' explanations about the possible reason, and sometimes related to insurance claims. When I recently witnessed the relative ease of chipping smoky quartz during setting, my thoughts turned again to the limited durability of gemstones. I was also intrigued by a significant number of cases of damage to or flaws in diamonds that appeared to have been systematically generated in diamond cutting factories during the cutting process.

The potential for damage depends on the different characteristics of gemstones, such as mechanical resistance, chemical resistance, thermal stability, stability of colour and the way in which a stone is cut. Damage may occur by mechanical or thermal exposure and also by chemical attack.

Damage to a gemstone may also occur because the wearer believes in the idea that 'a diamond is for ever'. Different types of damage are listed (right) as well as an analysis of the reasons for damage which unveil the critical moments during mining, cutting, setting, wear and tear, repair and cleaning.

All gemstones can be subject to damage – from diamond to turquoise, from ruby to opal. This article discusses some critical moments and how damage can be avoided.

Diamond

Diamond has a high scratch hardness, but is very sensitive to percussion and pressure during daily wear. Because of knocking and rubbing with other diamonds,

Types of damage

- Mechanical damage: breakage, cleavage, chipping, abrasion
- Thermal damage, cracking, decomposing, burning
- Chemical damage, etching, corrosion
- Changes of appearance due to colour fading, decomposition
- Loss of dream (psychological damage)

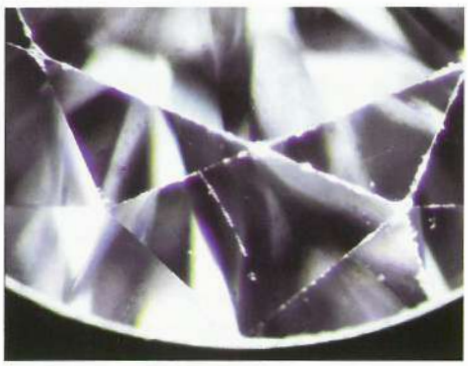
Opportunities for damage

- Geology, tectonics, metamorphosis, weathering
- Mining activity, handling of rough
- Cutting, polishing, setting
- Wear and tear
- Soldering (heat, tensions)
- Cleaning (ultrasonic, acid, solvents)

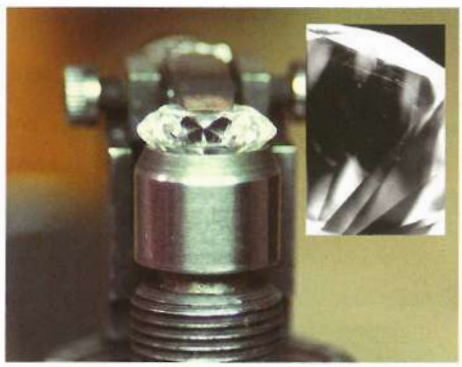
* This paper was presented at the 2008 Gem-A Conference

Hands-on Gemmology

Durability, damage and distress (continued)

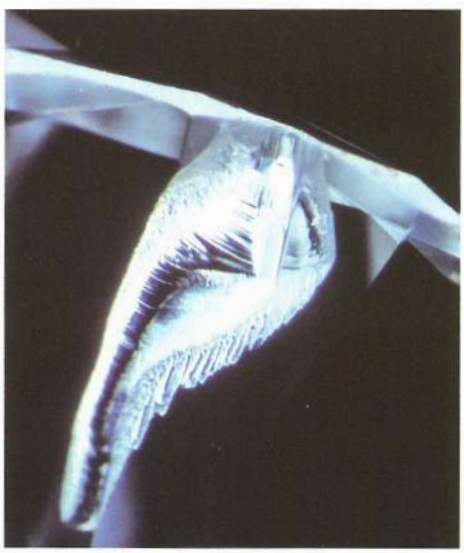


1. Worn edges and corners on a brilliant cut diamond with a scratch across a main facet. Diamonds are not indestructible but quite sensitive to knocks and contact with other diamonds.



3. Diamond particles under the metal clamp cause scratches when the stone is turned in the dop for crown facet cutting. Such scratches may be visible at 10x and preclude a loupe-clean clarity grade.

4. Forced closing of the claws of the dop for pavilion facet cutting may cause pressure marks. Such fissures may be visible at 10x and affect the clarity grade.



2. Chip on the girdle of a brilliant cut diamond, situated in an area where the girdle is thin. Thin or sharp edged girdles are potential damage zones.

facet edges and corners appear white after a period of wear (**1**). Sharp-edged or thin girdles on diamonds are particularly vulnerable to damage; they can chip during setting or later (**2**). But rough usage of diamond-cutting tools may have already created pressure or knocking fissures in the cutting factory; numerous diamonds leave the factory with small percussion marks (fissures) and scratches due to careless handling on the dop during the cutting process (**3** and **4**).

Another kind of damage to a diamond that may occur during the cutting process is a burned surface. The heat produced by the friction on the lap if the diamond is cut too quickly allows carbon atoms from the diamond surface to react with oxygen from the air and form volatile carbon dioxide (CO_2). This gas forms at the expense of the diamond surface which consequently is corroded and shows whitish burn marks (**5**). Boric acid is usually used to cool the diamond on the dop and coat it with an air-proof flux layer that inhibits the corrosion.

A frequent source of damage to diamonds is during repair of mountings when soldering is necessary. The flame of a torch is hot enough to cause the diamond to form CO_2 in the presence of air. A simple remedy against this corrosion is the application of a coating: a borax or boric acid layer protects the diamond and stops oxygen reaching the surface. Any fat or dirt, however, produces holes in this layer, and corrosion can take place (**6**). Therefore rings or other items of jewellery must be thoroughly cleaned before soldering. Surfaces of all diamonds must be coated with the protective borax layer when a ring goes under the torch.

5. Burned surface spots (burn marks) on a star facet of a brilliant cut diamond. Magn. 30x.

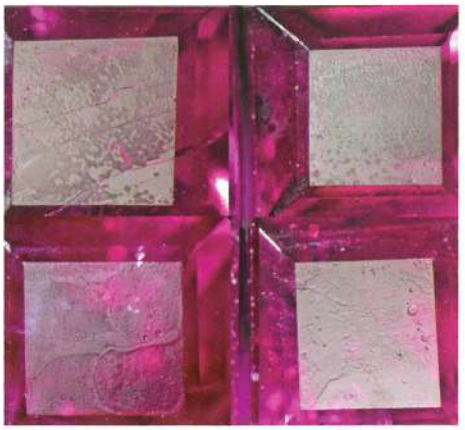
6. A soldering repair to a ring containing this 0.30ct brilliant cut diamond left the stone with a totally burned surface.

7. A stepped chip on a diamond facet edge, caused by a laser shot. In the centre of the crater a black spot of graphite is visible.

Durability, damage and distress (continued)

8. Wear marks on a sapphire mounted in a ring, with abrasions on facets, corners and edges.

9. A ruby with numerous twin lamellae and natural fissures, damaged by exerting too much pressure when attempting to re-set the stone with tongs.



10. Rubies with corroded surfaces due to dissolution by hot soldering flux.

Although soldering with a laser does not heat up the mounting or the stone, special precautions must be taken. Laser soldering may be dangerous for mounted diamonds since the energy of a laser shot may transform diamond into graphite. Either directly shot into the diamond or by reflection on the polished metal, the concentrated energy can quickly transform diamond into graphite. Graphite has a less dense atomic structure, and a transformation from diamond to graphite increases the volume of the treated area by 1.6×. If such a phase transition is just beneath the surface of a diamond, the pressure will burst the spot and a crater will be formed (**7**). A coating of black ink would stop a laser penetrating the diamond and would be good protection against such damage .

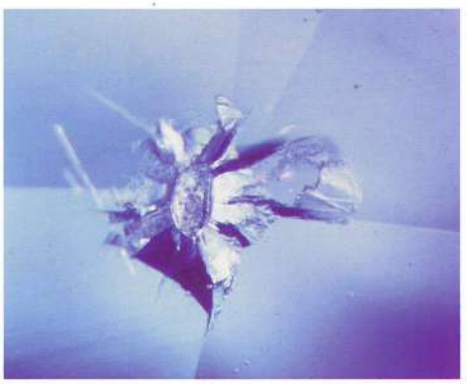
Ruby and sapphire

Corundum is a remarkably tough stone for a ring and is much less prone to chipping than diamond with its perfect cleavage. However, wear marks like rubbed edges and corners must be expected if sapphire- or ruby-set rings are worn regularly over a long period of time (**8**). However, if the corundum contains twin planes, these can behave like poor cleavage and be more of a problem; secondary minerals (e.g. boehmite) may crystallize on twin planes and create weakness. Generally ruby is much more affected by the formation of thin twin lamellae than sapphire. This can also lessen the transparency of ruby and represents a source of damage when force is applied, for example in setting. However, most of the rubies in the marketplace are heat treated with additives such as borax, the 'gluing effect' of which lessens the weakness making the problem of parting less likely.

A severe case of damage was encountered with an unheated ruby of over 10 ct that had been removed from its setting and was re-set with an inappropriate tool for closing the setting. The cushion-shaped stone showed two significant chips on opposite corners. I assume that when the stone was reset the claws were resistant to the pressure applied, so pliers were used to bring them back in position allowing more force to be applied and the stone shattered internally (**9**).

In some stones existing damage can be hidden or disguised by filling the open fractures with wax. Such fractures can become noticeable later in the life of the jewellery after thorough cleaning and although the appearance of a fissure may be new for the owner, an insurance company would not consider this fracture as new damage.

In rings containing sapphires or rubies, torch soldering can cause damage to the stones despite their usually good reaction to heat. In contrast to diamond, any borax should be kept well away from such stones: molten borax is a solvent for most minerals, and corundum can be heavily etched from such melt (**10**). Resulting corrosion can only be removed by re-polishing.



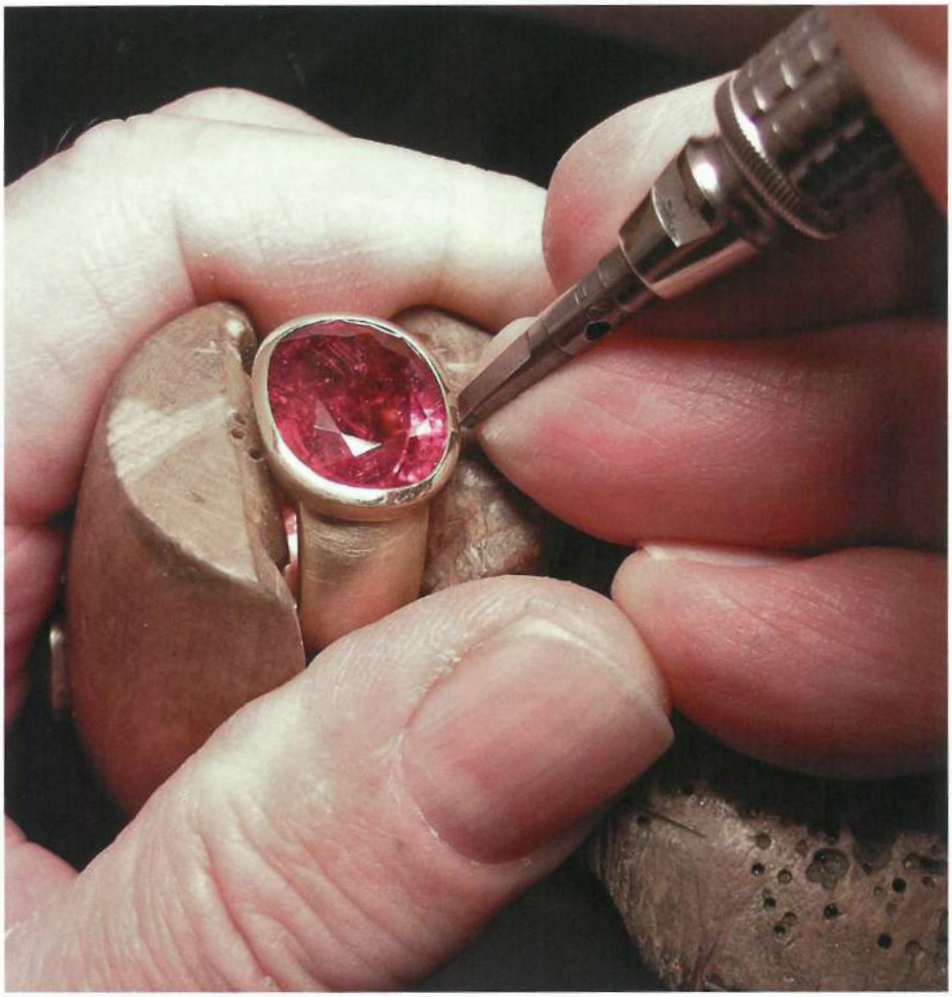
11. An increase in the volume of an inclusion of zircon with traces of uranium in a sapphire has caused tension and spalling or exfoliation of the surface. Magn. 25x.

Damage in corundum can be caused, although rarely, if a radioactive mineral inclusion is too close to the surface. The decay of uranium or thorium in zircon, uraninite or thorianite, for example, increases the volume of such inclusions. This creates stress in the surrounding host mineral and leads to fractures emanating from the inclusion. When such grains are close to the surface, the tension may 'spring' a thin layer of corundum, as seen in **11**.

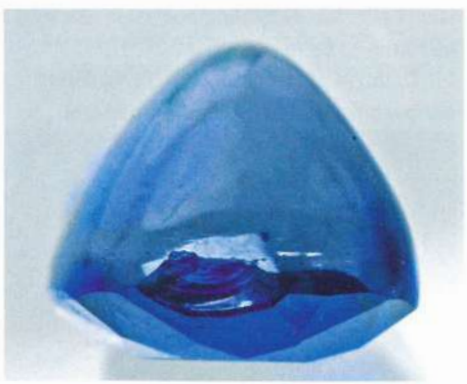
Despite its toughness, corundum is frequently damaged by careless gemstone setters who support their setting hammer on the stone instead of on the metal only (**12**). Closed settings often mask such injuries and

Hands-on Gemmology

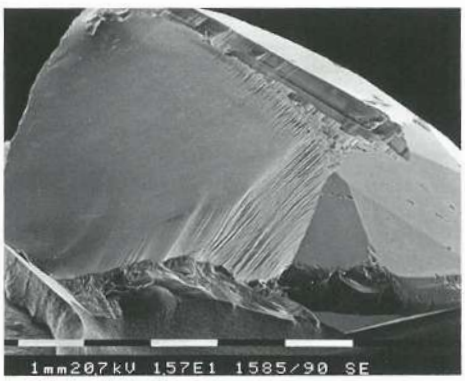
Durability, damage and distress (continued)



12. The setting tool must not touch the stone. This seems a logical precaution, but damaged stones are quite common with this type of blemish.



13.. A 12 ct Kashmir sapphire showing damage produced by a setting hammer. Re-shaping the outline of the stone means total re-cutting with a weight loss of at least 1 ct.



14. SEM picture showing the break structure of a sapphire damaged during enlargement of a ring. The force to break the stone comes from the culet and after a conchoidal break it ends in a stepped structure near the table of the stone. Length of white bar 1 mm.

the damage only becomes visible when the stone is unset. A typical example is shown (**13**) where a significant chip in the sapphire was exposed after it was removed from the setting. Re-shaping the contour of the stone results in a significant weight loss.

Other accidents happen with re-sizing where stones may be deeper than the depth of the ring head. On the sizing triblet or mandrel, the culet of the gem touches the metal and hammering the ring causes the stone to break; a sizing stick with a groove is highly recommended to avoid such damage (**14**).

Emerald

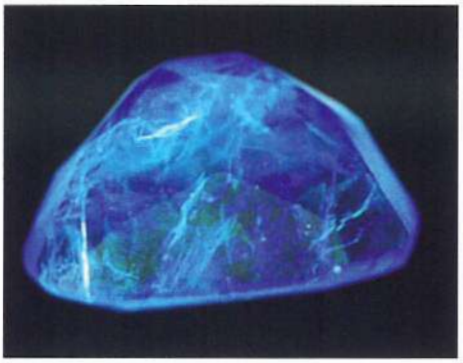
Emeralds are probably the gemstones most commonly associated with visible or hidden fissures. Tension in the crystal structure due to chemical substitution, tectonic forces on the parent rock and shocks during mining and separating the crystals from parent rock probably all contribute to the relatively high frequency of fissures in emeralds. They are often not recognized due to effective fracture filling, and nowadays sophisticated filling is standard wherever an open fissure appears. A later cleaning process however may remove some filling and allow air into the fissures, making them easily visible. Fissures in emeralds are generally present prior to the cutting process, a fact that can be deduced from polishing marks that emanate from the fissure openings. Organic fillings are usually visible in a dark room under long wave ultraviolet illumination: oil often appears yellow, whereas artificial resins (epoxy) appear bluish white (**15**).

Peridot

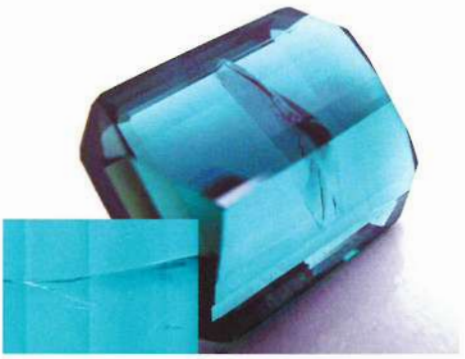
When a peridot was sent for analysis of the loss of lustre, it was first thought that a poor polish was disguised with surface waxing or oiling. The client, a goldsmith who bought the peridot from a cutter who had polished the stone himself, said that he had just cleaned the ring after having set the stone. Initially we thought that the polishing had been carried out with poorly graded diamond powder, but a reference

Durability, damage and distress (continued)

peridot from the same cutter showed perfect polish. After some questioning about his cleaning methods, the goldsmith mentioned submersion in pickling solution. A short experiment revealed that the said solution was able to attack the surface of olivine, a new experience for a gemmologist but maybe an old fact for an experienced goldsmith. The reference peridot is shown before and after its bath in hot pickling solution composed of sulphuric acid and nitric acid as it is commonly used in jewellery workshops (**16**).



15. Fissure-filled emerald seen in LWUV illumination. The extended network of bright lines shows a significant degree of treatment. The whitish fluorescence of the filler is typical for epoxy resin. Length of the stone approx. 12 mm.



17. A tiny scratch (left on inset) on the surface of this tourmaline has released a major fissure.

Tourmaline

During cutting, tension in some tourmaline crystals may be so strong that stones crack across the c-axis when they are sawn with the diamond blade. Heat treatment of tourmaline to enhance the colour often ends up with broken stones. Some tourmalines make it to faceted gems but may later crack or shatter at the slightest stress. It is clear that soldering a ring which contains a tourmaline is therefore quite risky and should be done with greatest care. Heat or ultrasonic vibrations may produce sufficient impulse for damage. Also the slightest scratches on the surface may release tension that causes a stone to crack (**17**). However, most tourmalines are not under tension and do serve many years as perfect gems.

16. The warm acid bath used after repair soldering has attacked the surface of this peridot; distinct corrosion is visible after only 20 minutes, making the surface matt. (a) Original peridot (b) after 20 minutes in pickling solution.

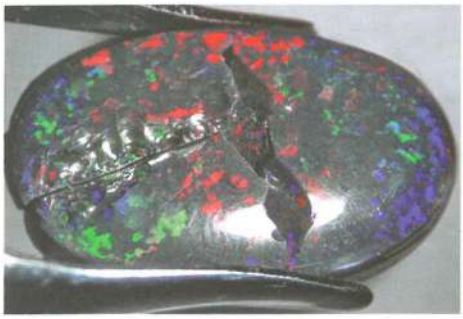
Jadeite

When clients bring gemstones back from their holidays, some can be very disappointed with the supposed bargain from the local market. One lady decided to have a pendant made from a small jade doughnut ring. The goldsmith produced a gold mounting and polished the pendant. During the process of ultrasonic cleaning in hot soapy water small parts from the surface broke off so that the surface structure became coarse. In the gemmological laboratory the jade was identified as B-jade, impregnated jadeite jade with an open structure. The filler and some loose surface jadeite had disintegrated and left an item that was unacceptable to the client (**18**).

18. A B-jade pendant with a rough surface after ultrasonic cleaning. The porous structure is due to disintegration of the impregnated material.

Hands-on Gemmology

Durability, damage and distress (continued)



19. To re-size or deform a ring may put considerable stress on a stone in a closed setting. This flat black opal cabochon broke when the goldsmith re-adjusted the ring.

Opal

Opals are among the more sensitive gemstones. Drying out is said to be the reason for their reported weakness. Some opals become fractured and show a web-like network of fine fissures. It goes without saying that a flat stone in a bezel setting would probably not survive a re-sizing of a ring because of the tension induced in the mounting. The flat cabochon illustrated (**19**) reacted to the slight deformation of the bezel setting.

Hessonite

Some hessonite garnets are coarsely polycrystalline and possess quite a rough fracture. Intense wear can break off the individual component crystals leaving the surface looking worse than if it had been just rubbed. One client presented a ring set with damaged hessonites for assessment (**20**). She said that the ring had been bought only five weeks previously and she wanted to accuse the jeweller of selling her fake stones. In fact the hessonites were natural gemstones but they had suffered from abrasion by the diamonds in the eternity ring worn on the next finger. Her daily use of a keyboard had caused the garnets to be rubbed repeatedly.

All photographs © H.A.Hänni, SSEF.

20. Friction between a diamond eternity ring and a hessonite channel-set ring caused the damage to the hessonite garnets (inset).

Acknowledgements

I thank my goldsmith friends who gave me access to their workshops during the last 40 years where I could experience their tools and techniques and discuss accidents and pitfalls when handling gemstones: Daniel Wyttenbach, Peter Gschwind, Alex Schaffner and Jörg Hänni, all in Basel, Switzerland. Most of the examples discussed in this paper concerned gemstones that were sent to SSEF Swiss Gemmological Institute for damage analysis.

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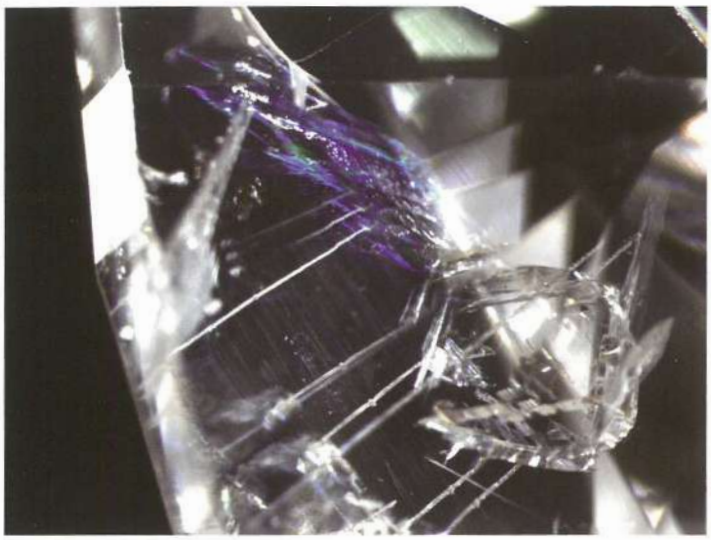
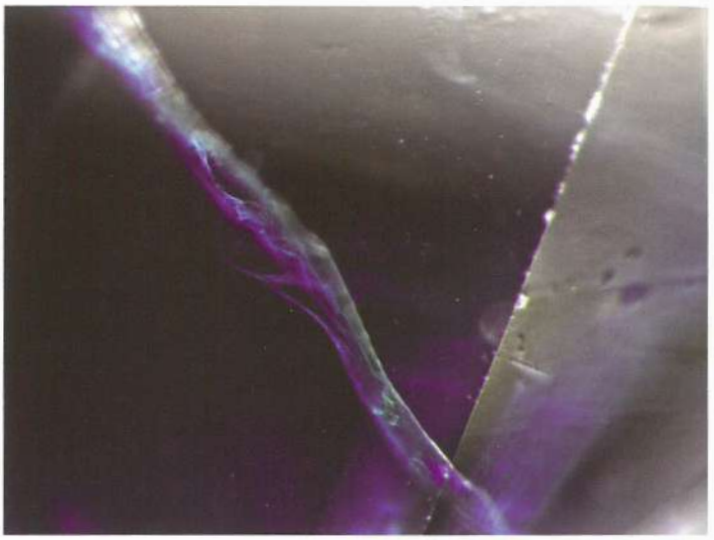
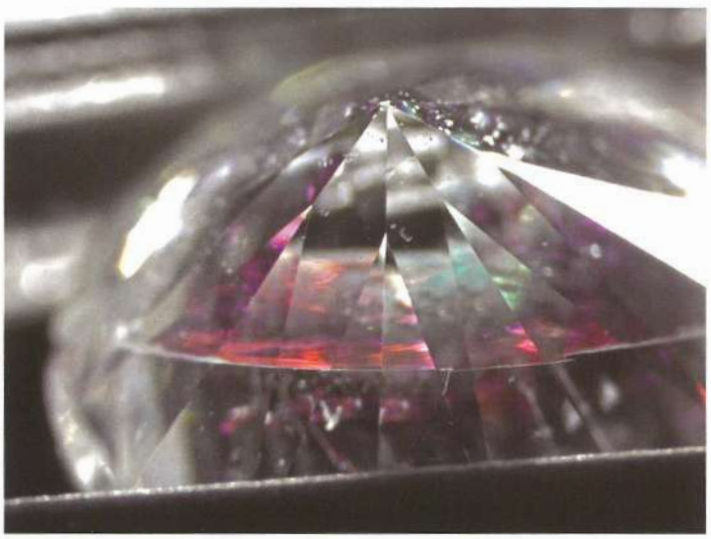
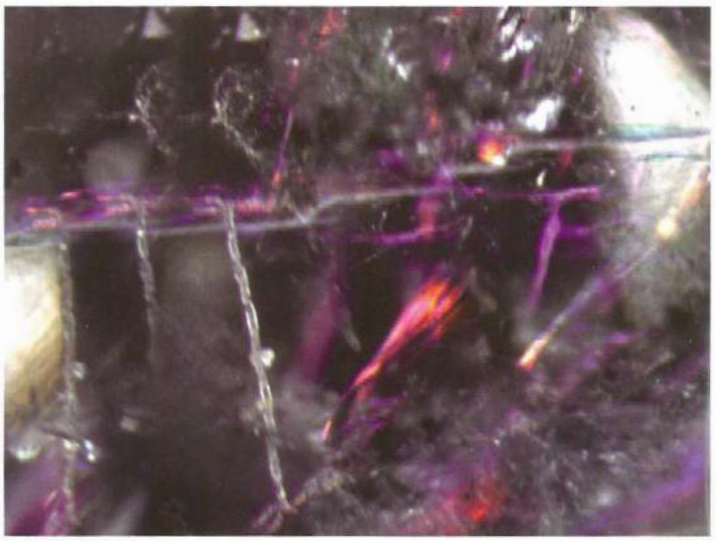
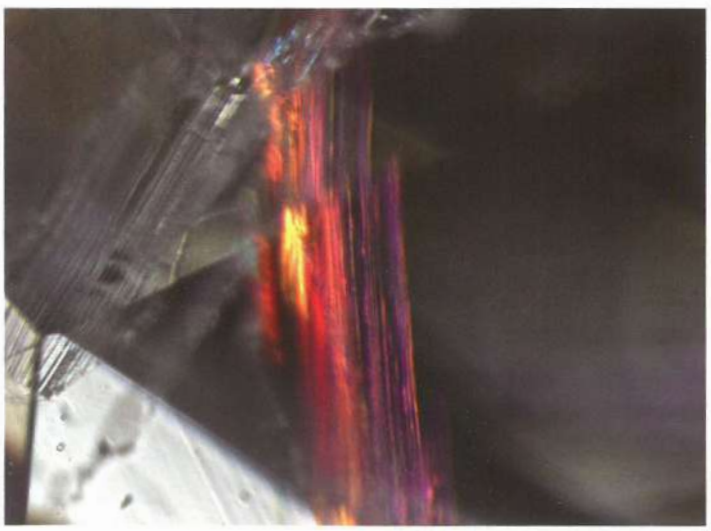
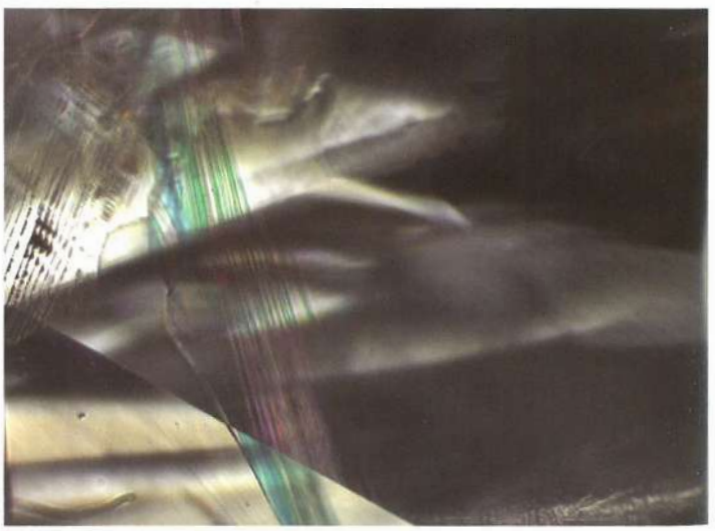

The filled fractures and the laser drill holes in the analyzed diamonds.

Clarity treated diamonds

Fracture filled and laser drilled diamonds have been known since the 1980s and from time to time heavily treated stones appear in the market. Recently Thomas Hainschwang of the Gemlab Laboratory, Liechtenstein, has had the opportunity to examine five specimens that were heavily treated and that were perfect objects for fascinating photomicrography.

Five 'near colourless' diamonds of 1.10 to 1.70 ct were submitted by a client to the GemLab for grading. Even with the unaided eye, the stones appeared to be of low quality.

Microscopic examination revealed that not only were all the stones fracture filled, but also that they had been laser drilled (see photomicrographs opposite and above). Such heavily clarity-treated diamonds are very rarely seen in the lab, particularly those that have been sold to a client without any comment concerning the treatments.

Glass with an RI as close as possible to that of diamond is used for the fracture filling of diamonds; the stones are filled at temperatures estimated to be between 400 and 600°C, under high pressure.

Dendritic crystallites in a glass-filled fracture

An interference effect may be observed because of the slight difference in RI between the thin layer of glass and the diamond. However, a similar usually more colourful effect may be seen in fractures containing air, so it should not be taken as conclusive evidence that the stone has been treated in this way. Typically the flash effect observed from a glass-filled diamond is blue to purple, reddish and red-orange, or orange to blue-green or green. In some cases it is possible to identify the treated stones by small bubbles and flow lines in the glass and, very occasionally, the glass starts to crystallize locally and small domains of crystallites can be seen (see below left).

X-ray imaging and EDXRF chemical analysis are being used for stones where the flash effect is not sufficiently strong to reach a conclusion. The material used is chemically very distinct from diamond and at least lead or bismuth will be determined by EDXRF analysis, since it is extremely likely that one of them will be present in all materials used for fracture filling of diamond. X-ray imaging is very efficient to visualize the filled fractures, since the glassy substance used is much more opaque to X-rays than diamond.

As the treatments to the diamonds submitted were obvious by microscopic observation, advanced testing techniques were not necessary.

This and notes of other items examined at Gemlab can be viewed at www.gemlab.net/website/gemlab/index.php?18-

All photos courtesy of Thomas Hainschwang.

The market in synthetic diamonds

Harry Levy reviews the processes used to manufacture white and fancy coloured synthetic diamonds and talks about the ways in which they are priced. He goes on to report on the current debates by international bodies over terminology and the way in which these stones should be described to ensure that there is no confusion over the product that is being sold.

At the time of writing we still do not have a large market for synthetic diamonds, especially white ones. We know they can now be commercially produced by two processes; high pressure high temperature (HPHT) and carbon vapour deposition (CVD). They both emulate nature, HPHT copying those diamonds that have been formed in the earth beneath volcanoes and other pressure points under high temperature and high pressure, and CVD which are produced in a vacuum and imitate diamonds detected in comets and meteorites.

The main colours produced by the HPHT method are intense yellow and sometimes brown, which in turn can be treated to produce pink. Occasionally the method can also be used to produce blue. The main colour produced by CVD is brown, which can be turned white by applying HPHT. The Gemesis Corporation are marketing their HPHT stones openly, but using agents and appointed dealers. They are trying to emulate the Russian method of distribution by selling mounted stones, although a number of loose ones are reaching the market, especially small yellows. The known producers of the CVD process, Apollo Diamond Inc., do not seem to have any sort of large scale distribution to the jewellery industry, perhaps because they originally set out to supply synthetic diamonds to satisfy the computer industry by producing thin slabs as semi-conductors.

We know that synthetic diamonds are also produced in Russia and probably China, but little is known about their methods of distribution. Synthetic diamonds are difficult to detect using only loupes and the human eye, so there can be a temptation to mix such goods, especially small ones, with natural diamonds. The original producers seem to market their stones as synthetic, but one does not know how these are named or tracked after sale.

When cubic zirconia (CZ) first appeared on the market, some manufacturers of jewellery put a few CZs in with small diamonds in cluster rings. Such stone mixing was not spotted when the rings were new but, as the CZs are softer than diamond, with wear and tear they soon lost their lustre and looked tarnished. However, if natural and synthetic diamonds were mixed, they would not be distinguished through differential wear.

Simple instruments were produced to detect the simulants, using heat conductivity to detect white stones that were not diamonds, even mounted ones. There are no similar instruments yet to differentiate between synthetic and natural diamonds. Laboratories

claim that they can make the distinction, but again they need expensive and sophisticated instruments. This is why it is important that there is proper disclosure every time such stones are sold.

Pricing

There is no clear price structure for synthetic diamonds. Prices depend on the costs of manufacturing and marketing such stones, and it is natural that at each stage the supplier would try to maximize the price. Currently prices are set in the light of prices of similar-looking natural stones, and costing in a discount of say 50 percent, to make the product attractive in the market place.

" ... it is difficult to imagine that someone would pay many thousands of dollars for a man-made diamond."

There was a similar situation at one time with CZs, although their prices dropped very rapidly through improved production methods and most importantly through competition. At present CZ stones are selling very cheaply, based on low production costs of both the rough and the cutting and polishing.

A similar process will happen to synthetic diamonds. Prices will come down through competition. It is technically difficult and expensive to produce stones of about one carat and larger. Gemesis recently announced that they had no immediate plans to produce white stones of about one carat, as the prices at which they would have to sell them would be too close to their natural equivalents. But with the recent large increase in prices for natural diamonds of over three carats, similar sized synthetics could become an attractive alternative. At this stage it is difficult to imagine that someone would pay many thousands of dollars for a synthetic diamond. An important element in the price structure for natural diamonds is their rarity value; large gem-quality diamonds are scarce, but eventually synthetic ones could be produced at will.

We have a similar situation with coloured synthetic diamonds. Natural brown and yellow diamonds seem to satisfy market demands, but with good marketing prices for such stones are increasing, so a similar stone offered at a discount of 25 to 50 percent becomes an attractive alternative. Natural blue and pink diamonds are extremely rare and thus extremely expensive, so paying a million dollars or more for a stone may be attractive as an investment to a buyer, but I cannot see anyone paying, say, half a million dollars for a synthetic stone, knowing that such stones could be produced on demand. So the prices of synthetic pink and blue diamonds bear no relation to natural ones. We are told they are much more expensive to produce than the yellow and brown ones, so they are sold at several thousand dollars per carat, but would not reach six or seven figures.

So far we have not looked at another alternative to the synthetic diamonds. These are the treated natural diamonds. For a number of years blues, blacks, browns, some pinks, purples and other hues have been produced through irradiation and HPHT, and more recently natural diamonds have been coated; these sell at prices similar to those of near-colourless stones of similar clarity. When such treated stones first appeared low-grade natural diamonds were used and the price was dependent on the colour alone, but in recent years clarity has become a more important factor and prices of such treated stones have risen. But it should be noted that the main value of a treated coloured diamond is based on the value of the original diamond used, and not on a discount of the price of an equivalent natural coloured stone, especially in the pink and blue ranges.

Terminology

Returning to synthetic diamonds, the natural gem trade has always been wary of this competition, and much of the rules and regulations regarding nomenclature and disclosure have been predominantly devised by those dealing in natural stones.

The question of terminology has recently become a trade debate again. Traditionally all synthetic stones with the physical and chemical properties of their natural counterparts, have been designated as 'synthetic'. Those that merely simulate the appearance of a natural stone have been designated as imitation, paste or fake (faux). The term 'synthetic' was accepted, with its specialized meaning, and used for the Verneuil (flame fusion) produced spinels and corundums. This position was challenged when crystal growers such as Chatham and Gilson brought their products to the market. They claimed their stones were 'better' than the Verneuil stones and wanted a differentiation in terminology. They tried to introduce the term 'cultured' and were challenged particularly by those in the pearl trade. After much debate and litigation it was finally agreed in the USA, where the litigation occurred, that terms such as 'laboratory grown' and 'laboratory created' could be used. Bodies such as CIBJO disagreed with this and insisted that the only permissible term for such synthetic stones was 'synthetic'.

"Bodies such as CIBJO ... insisted that the only permissible term for such man-made stones was 'synthetic'."

This position was again challenged by the producers of synthetic diamonds, who tried to market their products as 'cultured diamonds'. They claimed that the term 'synthetic' had the connotations of 'fake' and they did not want to have to use the terminology which was associated in the public mind with that used for glass and other products merely imitating the appearance of diamonds. To put it very simply, they argued that their products were diamonds, the only difference being their origin.

The term 'cultured diamond' was almost universally challenged by the entire industry; a court case was won in Germany banning

Around the Trade

The market in synthetic diamonds (continued)

Naturally Speaking

It might seem strange to gemmologists and jewellers to have to 'define' a diamond. But the truth is that you can't start to suggest how such things as synthetics and treatments should be described and disclosed until there is an agreement about what we mean by 'diamond'. So, CIBJO (The World Jewellery Confederation), in its Diamond *Blue Book* defined diamonds as follows:

"Diamond is a natural mineral consisting essentially of carbon crystallized in the isometric (cubic) crystal system. Its hardness on the Mohs' scale is 10; its specific gravity is approximately 3,52; it has a refractive index, n_D, of 2.42."

Near identical definitions have been used more recently by the International Diamond Council (IDC), Centre for European Standard (CEN) and the Hong Kong Government in its diamond grading standard. However, even more recently the Responsible Jewellery Council (RJC) published their diamond definition and this was met with what might best be described as derision by the diamond and gem worlds, and a flurry of emails on Gem-A's MailTalk.

The RJC's initial definition was as follows:

"A mineral (natural or laboratory-grown) consisting essentially of pure carbon crystallized with a cubic structure in the isometric system. Its hardness on the Mohs' scale is approximately 10; its specific gravity is approximately 3.52; it has a refractive index of approximately 2.42; and it can be found in many colors."

The derision was aimed at several bits of this. Since when can a mineral be 'natural or laboratory grown'; Mohs' hardness of 10 is defined as the hardness of diamond, a diamond's hardness cannot be 'approximately' 10 on the Mohs' scale (even though diamond shows directional hardness); and what on earth is meant by 'carbon crystallized with a cubic structure in the isometric system'?

In the light of the trade comments, RJC quickly modified its definition, which now reads as follows:

"A diamond is a natural mineral consisting essentially of pure carbon crystallized with a cubic structure in the isometric system. Its hardness on the Mohs' scale is 10; its specific gravity is approximately 3.52; it has a refractive index of approximately 2.42 and it can be found in many colors.

"A laboratory-grown/synthetic diamond is any object or product that has been either partially or wholly crystallized or re-crystallized due to human intervention such that it meets the requirements specified in the definition of the word 'diamond', with the exception of being non-natural."

However, there is a still a question about all the various definitions. They refer to diamond as 'a natural mineral'. The term 'mineral' implies natural – you cannot have a man-made mineral. The case was succinctly explained by Brian Jackson FGA in a MailTalk email:

"'Natural' in the term 'natural mineral' is redundant.

"A mineral is defined by the Commission on New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (IMA) as an element or compound that is normally crystalline and that has been formed as a result of geological processes.

"Anthropogenic substances (also defined by the CNMNC) are those produced by Man and are not regarded as minerals. If such substances are identical to minerals they can be referred to as 'synthetic equivalents' of the mineral in question, e.g. synthetic corundum.

"It is not unheard of for different disciplines to use the same terms but with different meanings. However it would be unwise for the closely allied disciplines of mineralogy and gemmology to begin to diverge on this fundamental issue."

The mineralogical use, as above, of 'Anthropogenic' actually ties in well with Harry Levy's advocacy of the use of man-made since 'anthropogenic' is from the Greek meaning produced or caused by man. Brian's email also referred to the situation regarding 'Anthropogenically modified minerals', that is treatments, which he notes as being 'more complex'. That is an understatement, but a somewhat separate matter that will be looked at in the next issue.

Jack Ogden

the term and a petition was sent to the American Federal Trade Commission (FTC) for their view. The FTC, which allows terms other than 'synthetic' to be used with coloured synthetic stones, came out with a ruling that did not ban the term 'cultured' when applied to diamonds, but said that it must be qualified with other terms such as 'synthetic', already permitted in its lexicon.

The matter was taken up in Europe and a European Committee for Standardization (CEN) workshop was set up, open to all to attend, but many thought without enough publicity. The producers of synthetic diamonds were invited to attend, a rare trade occasion in permitting them to a trade conference. Surprisingly those involved with the natural diamond industry supported the FTC solution, but all still wanted a total ban on the term 'cultured' when applied to diamonds. Thus bodies such as The World Federation of Diamond Bourses (WFDB) and International Diamond Manufacturers Association (IDMA) passed a resolution admitting alternative terms for synthetic diamonds. This position was supported by the producers, i.e. the miners of natural diamonds.

The only dissenting voices were those of the European non-English speaking delegates of CIBJO who have always insisted on the use of the single term only, namely 'synthetic'. This will again be debated at the CIBJO Congress in Istanbul in May this year. Their

The market in synthetic diamonds (continued)

main claim is that the public will be confused if terms other than synthetic are used.

Since maintaining public confidence and avoiding confusion is such an important issue, it is time the trade instigated a proper survey, by a neutral body, as to exactly what the public and consumers understand by the term 'synthetic', and by other similar terms, at least in English. I very much doubt whether the average person in the street will understand the difference between fake, synthetic and imitation in the way we do in the trade.

I have frequently proposed the term 'man-made' as I find this the most unambiguous word. The aim of the industry is to protect the public and they want no confusion when describing the origin of a product, not as to what it is imitating. In trying to ban the term

> *" ... there is patently no ambiguity in calling a product man-made."*

'laboratory grown', the argument is that the public will think that this is a natural product. To anyone who speaks and understands English there is patently no ambiguity in calling a product man-made. I can understand someone thinking that a 'synthetic diamond' is a fake or imitation diamond and not a stone with all the physical and chemical attributes of a natural diamond, but I cannot see anyone thinking that a 'synthetic diamond' is a natural product that has been dug out of the ground.

During the emotive discussion in the CEN meeting, at which both sides thought that they were 'trading' when discussing terms, it was agreed to drop the terms 'cultured' and 'man-made'; in my opinion it was an error to omit the latter term. The main argument against its use appeared to be its sexist connotations. This was part of the give-and-take, although the CIBJO delegates were overwhelmed by the numbers in the room who wanted an expanded definition. The synthetic diamond producers abstained in the vote. The final vote was for the expanded terminology and puts Europe much more in line with America and the IDC guidelines.

There will be confusion if actual misleading terms are used or if there is no disclosure.

If a consumer is sold a diamond the assumption will be that it is a natural stone. I very much doubt that a consumer would think a stone was natural if told that it was man-made, laboratory-grown or laboratory created, or a synthetic or even a cultured diamond.

There is much confusion in the pearl market in that the majority of pearls sold are cultured. These include the highly expensive large South Sea pearls. But not many are now designated as being cultured and thus not differentiated from a purely natural one. The importance again is in value, as natural pearls are much rarer and thus more expensive in contrast to the more numerous cultured ones.

The latest twist in the story of synthetic diamonds is that their producers have now been accepted into the Responsible Jewellery Council (RJC), formerly known as the Council for Responsible

Jewellery Practices (CRJP). This was a body set up to look at the ethical issues involved in the production and sale of jewellery. In order to accommodate companies such as Gemesis they have had to alter their definition of 'diamond'. Their original definition stated that diamonds were a natural product and the main mining groups were an important part of RJC. There has been some derision from those who understand the more technical aspects of the trade, to their new definition. I hope the definition will be changed to address these points, but the important thing is that bodies such as RJC, as well as the older ones such as CIBJO and the International Diamond Council (IDC), are there to protect the trade, synthetic producers included, and the consumer.

Providing that these bodies share the same views and propose the same guidelines to terminology and disclosure, the trade and thus the consumer will benefit greatly.

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Tucson 2009

Olga Gonzalez reports on the effects of the credit crunch for exhibitors at the Tucson shows and how they fared.

If you are in the gem trade or are an enthusiastic collector of gems and minerals, the first two weeks of February should be a 'must-see' on your calendar. Migrate from your cold home climates and embrace the Arizona heat and the phenomenon of the Tucson shows. With over 40 shows spanning every street, hotel and venue in the city, it is a buyer, networker and exhibitor paradise. However, with the nervousness building up around the economic state we are currently in, there was much apprehension building up around how the Tucson shows would fare.

Many of the exhibitors I spoke to went in with little or no expectations, but of course there were others that were holding onto the idea that sales during the Tucson shows would bring a much needed financial boost to their companies. Those in the latter category may have been disappointed, but those who didn't have expectations were often pleasantly surprised. The reality of the situation is that the credit crunch does affect consumer spending. In Tucson, the obvious consequences were that overall attendance was down and those who were buying generally bought less and took their time to really consider their purchases. I saw a pattern of less compulsive buying and more people wanting to see everything before deciding on where to spend their money, and then going back later to make their purchases.

The positive side is that people are still buying and they are still attending the shows. The challenge to the exhibitors is that they need to really stand out and be the company that buyers want to purchase from. Some exhibitors had fantastic sales this year, but their staff, products and booths often stood out above the rest, which made them desirable to work with. Ben Kho from Kho International Ltd. commented: "There is lighter traffic and there are serious buyers, but they are not buying that much," while Benjamin Hackman from Intercolor USA said: "Everyone is in the same boat. Everyone is cautious about spending money." While browsing the shows, it became apparent that the market was doing best with the high-end and the rare. Brad Wilson of Coast to Coast Rare Stones International had "an unbelievable first day of the show" and noted that much of their business came from repeat customers. Having a niche product and a great sales team is key for doing well at the shows; with large quantities of anything you could want available in Tucson, those with something unique to sell had the most success.

Other products that did well were high-end and rare minerals, which were exhibited beautifully during the Tucson Gem and Mineral Show in the Tucson Convention Center. In addition, education seems to be doing particularly well. Many people are deciding to go back to school full-time or want to supplement their careers with another qualification that they can complete from home. At the Gem-A booth we were very happy with the interest in our new Open Distance Learning programmes and the positive responses regarding our updated Foundation in Gemmology course notes.

Finally, the networking opportunities in Tucson were tremendous. Events hosted by the AGA, ICA, GIA and the AGTA ensured that there was plenty of time to meet to new people and work together to create partnerships and develop new ideas to bring the trade forward into an exciting and new era. It is important to attend and support gem and jewellery trade shows internationally, whether you buy, exhibit or collect, and if you didn't get a chance to see the incredible variety of gems available this year, make sure to book early for next.

AGTA Spectrum and Cutting Edge Awards

The glamorous AGTA Spectrum and Cutting Edge Awards are an event not to be missed while visiting the Tucson gem shows. Talented gemstone cutters and designers are recognized amongst their peers for their innovative creations across 17 categories. Whereas the Spectrum Awards are awarded to the best use of gemstones and pearls in fine jewellery design, the Cutting Edge awards honour the lapidary arts. The designs and cuts set a high standard in the industry and inspire creative competition year after year.

Frederic Sage's Enchanted Stallion brooch (**1**) featuring a 158.26 ct carved turquoise, white diamonds and demantoid garnets won Best of Show and Evening Wear and exemplifies the exceptional quality produced across the many categories. A platinum Kaleidoscope X2 ring by James W. Currens (**2**) which won Best Use of Color and Fashion Forward, displayed a particularly imaginative use of the colours and properties of gemstones. Other highlights included Judy Evans's elegant platinum earrings featuring morganite briolettes accented with diamonds which swept the Bridal Wear category and a star rose quartz ring with a pink sapphire and diamond surround by Jennifer Rabe Morin won a place in Business/Day Wear category (both featured on the front cover).

James W. Currens also impressed the judges with his 34.80 ct. natural boulder opal fancy cabochon (**3**), which won the Open Category Phenomenal for the Cutting Edge Awards, and distinguished itself as particularly unusual and elegant. Everyone's quirky favourite was Cheese, a carving by Dalan Hargrave (**4**) which features Juniper Ridge fire opals and depicts a mouse reaching to sniff a plate of cheese that is just out of reach— it is the perfect accessory for any dining experience.

In the trade we should certainly be thankful to AGTA for providing a forum for talented individuals to create these imaginative entries and beautiful contributions to jewellery and the lapidary arts. Now all we need is a website for some online award show shopping ...

3

1

1. 'Enchanted Stallion' brooch by Frederic Sage. A 158.26 ct hand-carved enhanced turquoise, diamonds and demantiod garnets set in 18 ct gold.
3. A 34.80 ct. natural boulder Opal fancy cabochon cut by James W. Currens.
4. 'Cheese' carving featuring a full range of Juniper Ridge fire opals by Dalan Hargrave.

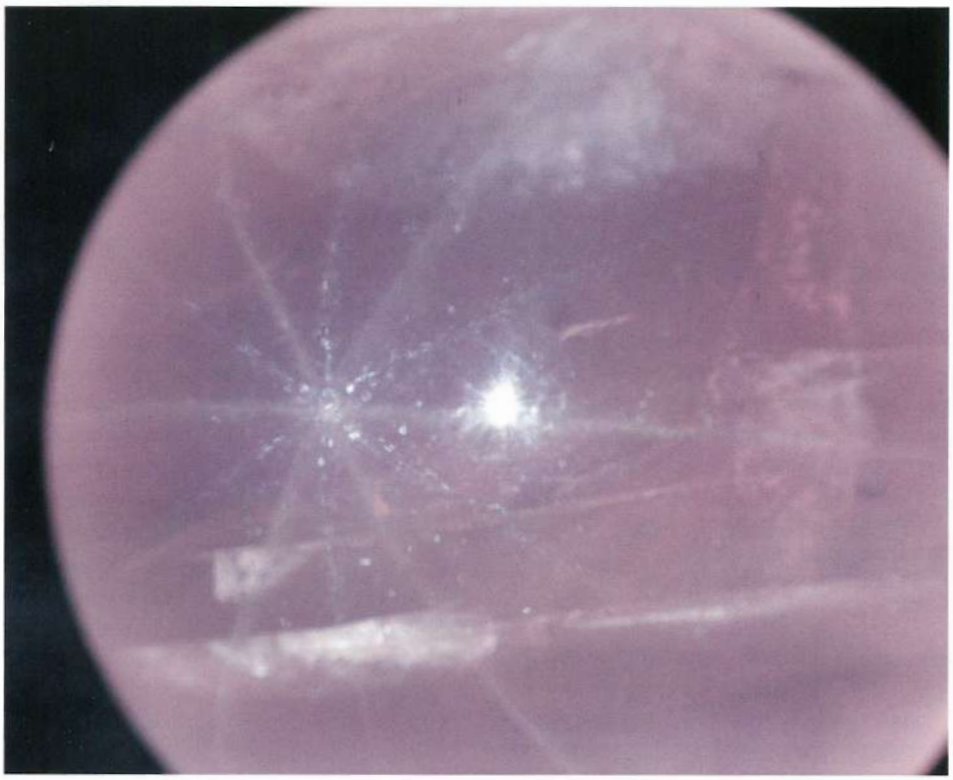
All photos courtesy of AGTA.

4

2

James Currens' amazing 'Kaleidoscope X2' ring, composed of amethysts, aquamarines, fire opals, topaz, citrines, garnets and tourmalines beneath an 85 ct crystal dome, with surrounding diamonds. Said James: "I loved the myriad of angles and the layering of colours that the kaleidoscope brings to life. This was my mission as I sat at the faceting machine and started to cut the first long splinters. Each stone was hand cut and all were different from each other. The gemstones were then layered, using all their natural beauty and their ability to distort light and perspective. The piece was difficult but the result was better than I imagined possible."

A twelve-ray star rose quartz from Madagascar



Harold Killingback finds rare twelve-ray quartz spheres during a Gem-A trip to Madagascar. His tests on a sample that he acquired produced surprising results. Were there in fact two six-rayed stars and, if so, could the effect be caused by different mineral inclusions?

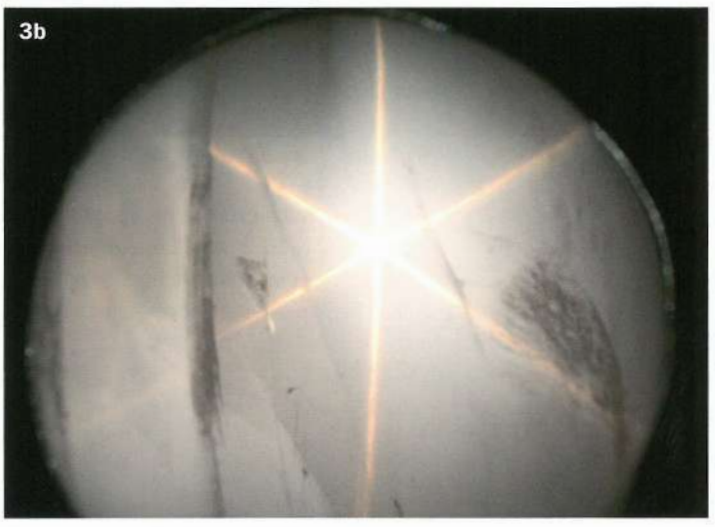
In 2006, I was fortunate to go on the Gem-A trip to Madagascar, where I was introduced to Alain Daso. One of his special interests is in spheres cut from the twelve ray star rose quartz found there. He has coined the term 'twelve-ray suns', to distinguish these from the commoner six-ray stars. He told me the twelve-ray spheres are in great demand in China. (Whether their naming as 'twelve-ray suns' and their popularity, particularly in China, has anything to do with the twelve-ray sun symbol of the Quo Min Tang party I do not know.)

From a practical point of view, however, the result is that these rare spheres are expensive, but I was able to buy one of the less striking examples. It averages about 49.5 mm in diameter and weighs 170.5 g. It is shown illuminated by a point source of incandescent light from beside the camera, i.e. we are seeing epiasterism (**1**).

Like most rose quartz, this specimen has many fissures so a lot of light is scattered back towards the camera, competing with the reflections forming the star and thus somewhat obscuring them. So I tried again, this time submerging the sphere in water. This reduces reflection from the upper surface (the wet pebble effect) and also from the back surface. Doing the latter is especially important because, if the sphere were sufficiently free of inclusions, an extra star could be observed (as shown in 4a and 4b of my earlier paper[1]). This extra star is due to reflection from the back surface of the

Sphere in water — epiasterism

Sphere in air — diasterism



The 49 mm sphere (2) in water, epiasterism, and 3 in air, diasterism, a and b showing opposite poles.

sphere and I wished to minimize the possibility of its appearing, in order to avoid confusion between this effect and the phenomenon shown in **1**. The effect of immersion is that the angle of total internal reflection is increased from about 40° for quartz in air to about 59° for quartz in water, so making it more likely for light to pass through the sphere and be absorbed by the black velvet on which it rests. (A closer match of refractive indices could have been obtained by using, say, liquid paraffin. This would have raised the critical angle to about 71°, but, as the sphere has to be manipulated to get the desired image, use of anything other than water is messy.) The water has had the desired effect, as shown in **2a** and **2b**. There is much less back-scatter of light and the so-called twelve-ray star can be clearly seen.

Except that there is not a twelve-ray star. There are two concentric six-ray stars. Whether viewed towards one pole or the other, **2a** or **2b**, the stars are clearly different.

A surprise awaits when one attempts to observe diasterism, i.e. when looking against the direction of the incident light. There are not two six-ray stars any more, just one! Again, this is so whichever pole the sphere is viewed from, as shown in **3a** and **3b**. (Incidentally, it is also the case that the light spots that can be seen in epiasterism from some rose quartz spheres are similarly not seen in diasterism, at least, not in my examples.)

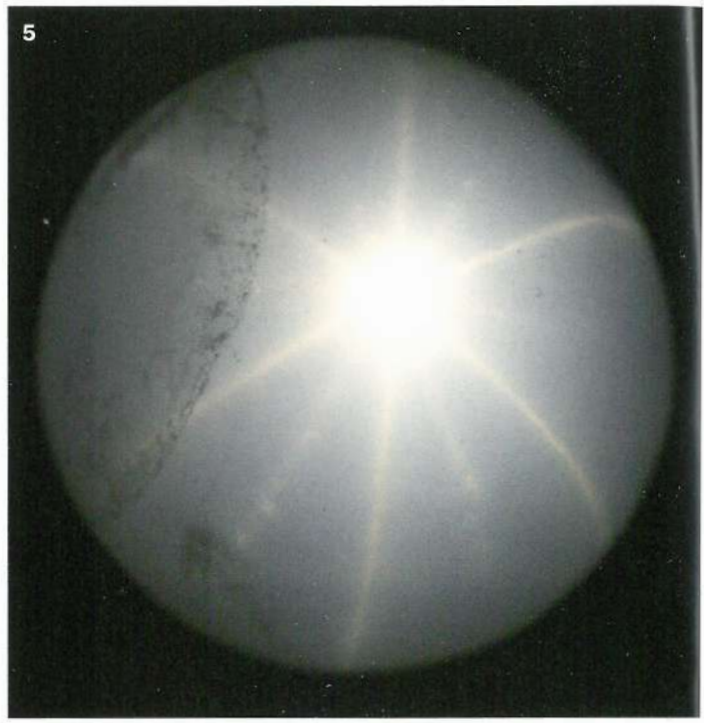
Moving the light source round the sphere, so that diasterism becomes epiasterism, it can be seen that the star which continues throughout the rotation and appears in both forms of illumination is the familiar one for rose quartz, i.e. of such fine structure that it looks like a homogeneous band.

The other star shows itself to be of much coarser structure and it does not reach so far round the sphere even as viewed in the epiasterism direction.

A twelve-ray star rose quartz from Madagascar (continued)

Sphere in water — epiasterism

Sphere in air — diasterism



The 16 mm sphere. 4 in water, epiasterism, and 5 in air, diasterism.

I have another rose quartz sphere which exhibits an apparently twelve-ray star. The sphere averages only 16.2 mm diameter and weighs 6.0 g. Even when immersed in water, it is very hard to see even a six-ray star (**4**) in epiasterism. The interesting observation is that in diasterism (**5**), there can be seen (albeit with difficulty) twelve rays. This is the opposite of the case with the larger sphere, but here again there appear to be two concentric six-ray stars, the arms of one of them extending less far round the sphere than those of the other.

Discussion

The differences in characteristics between the two six-ray stars strongly suggest that they are due to different minerals, as in the case of so-called twelve-ray stars in corundum. Webster[2] says that in these, exsolved hematite crystallized as needles parallel to the first order hexagonal prism form one six-ray star, and needles of rutile crystallized parallel to the second order prism, which is at 30° to the first, form the other. In this case, perhaps the inclusions are at 90° to one another (e.g., parallel to, and normal to, the a-axes). This also results in the rays being 30° apart.

It used to be commonly believed that rutile was responsible for the star in rose quartz, but Applin and Hicks[3] found that samples contained not rutile, but a mineral having characteristics similar to dumortierite, a basic aluminium boro-silicate. Professor Rossman and his colleagues[4] have gathered samples of star rose quartz from worldwide sources and dissolved them in hydrofluoric acid. They showed that the mineral differs from dumortierite but is related to it. It contains both Fe and Ti, substituting for some of the Al. Charge transfer leads to selective absorption of certain wavelengths of incident light and we see the residual colour as pink. So the fibres are responsible for the colour as well as for the star effect.

It would be interesting to dissolve some twelve-ray rose quartz and see what other minerals may be present. (Perhaps rutile will, after all, be accepted as an ingredient!) The geometric shape of the crystals should be examined to see if this would account for the fact that (in the 49 mm sphere, at least) they do not give rise to diasterism. The cause of the contrary behaviour of the material of the 16 mm sphere might be similarly examined. Hydrofluoric acid, however, is not a material which I am equipped to handle.

Clearly there is much to be learnt. I hope, however, that by highlighting the problems, I may have encouraged others to solve them. (Maybe, dissolve them would be a better prescription!)

All photos by Harold Killingback

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Amanda Good describes her delight when she discovers gem crystal structures depicted in fabrics during a visit to a Festival of Britain exhibition.

From atoms to patterns

I recently visited the Festival of Britain exhibition at the Wellcome Collection, London, to see designs for fabrics and wallpapers which had been based on the atomic structures of substances such as insulin. You can imagine my pleasure when I discovered designs featuring the structures of orthoclase and beryl.

The 1951 Festival of Britain provided a platform for British ingenuity and creativity in science and the arts. One of the boldest initiatives was the Festival Pattern Group, which brought together adventurous manufacturers with cutting edge crystallographers to create a collection of quirky furnishing designs.

Inspired by the intricate patterns of crystal structures, leading Cambridge crystallographer Dr Helen Megaw came up with the novel idea of using them for textiles. She collated crystal structure diagrams from eminent colleagues and ensured that they were interpreted in an accurate and authentic way. World-renowned Nobel prize-winning scientists involved in the project included Sir Lawrence Bragg, one of the founding fathers of X-ray crystallography and President of the Gemmological Association of Great Britain from 1954 until 1972.

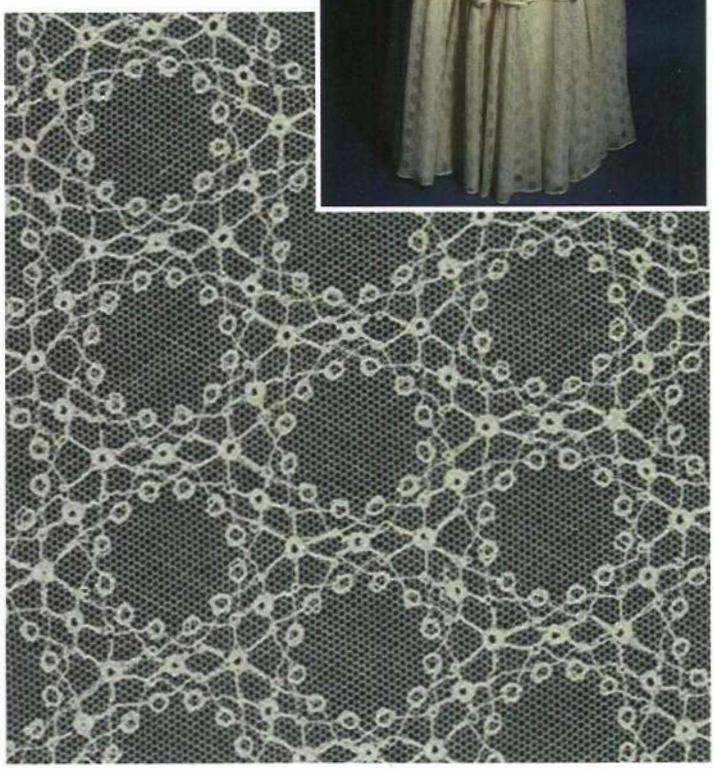
Science enjoyed great popular appeal during the early post-war period, and X-ray crystallography was one of the most exciting fields of science at the time. The process involves a narrow beam of X-rays being passed through a crystal, the shadows cast by the diffracted X-rays are photographed and from the resulting patterns the arrangement of atoms can be calculated.

Crystallographers at the time took pride in attending conferences and other functions wearing fabrics showing the atomic patterns of their own specialities. Silks woven to make stunning ties were displayed, one of which had been worn by Dr Judith Milledge, a Gem-A Gem Diamond Examiner from 1973 to 1982. Pictured is machine-embroidered lace which features one of the Sir Lawrence Bragg's crystal structures, beryl, a group of minerals composed of hexagonal crystals. A dress of this lace was made for Sir Lawrence's wife, Lady Alice, to wear at the Congress of the International Union of Crystallography (IUC) in Stockholm in 1951. Sir Lawrence, who was President of the IUC, gave a special address at the conference, which was attended by 340 crystallographers from all over the world.

The crystal structure of orthoclase was also displayed, as worked on by the crystallographer Dr W.H. Taylor and the jacquard furnishing fabric was produced by Old Bleach Linen Company.

A dress of lace featuring the beryl crystal structure made for and worn by the wife of Sir Lawrence Bragg. Details of the lace is given below.

Crystallographer: Lawrence Bragg. Lace designed by H Webster for A C Gill. Image of dress: Nottingham City Museums and Galleries. Image of lace: © V&A Images/ Victoria and Albert Museum, London

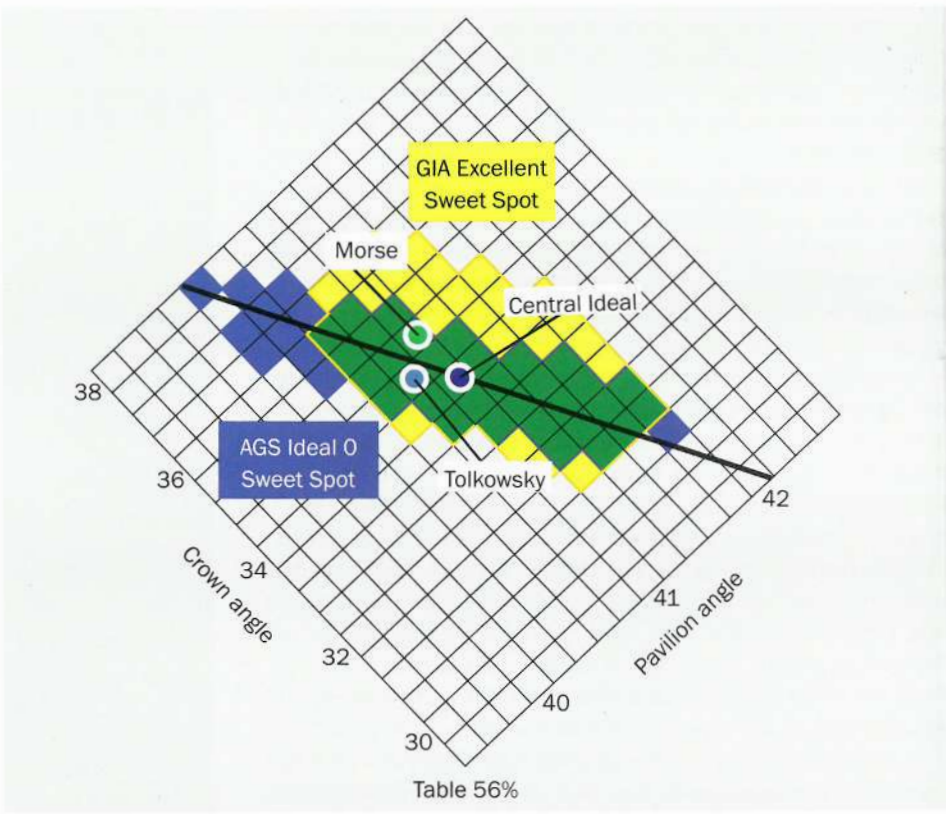


The Central Ideal

Have you heard of the 'American Ideal' or 'Tolkowsky Ideal' in diamond cutting? How about the 'Morse Ideal'? Michael Cowing explains that because a majority of diamonds are fashioned as 57-facet round brilliants, many are familiar with the 'Holy Grail' of this cut, the 'Ideal' brilliant. The diamond trade often refers to this cut as the American or Tolkowsky Ideal. GIA's Al Gilbertson, in *The American Cut — The First 100 Years*, establishes the origins of the 'Ideal' with one of the first American diamond cutters, Henry Morse, in Boston back in the 1860s. This ideal in diamond fashioning was gaining in popularity when Marcel Tolkowsky published his book *Diamond Design* in London in 1919. Tolkowsky's book and the subsequent promotion of his theoretical cutting angles by the Gemological Institute of America (GIA) and the American Gem Society (AGS) resulted in recognition of the 'Ideal' worldwide.

Tolkowsky's mathematics and ray tracing validated the angles Morse had developed, and resulted in the acceptance of Tolkowsky's theoretical pavilion and crown main angles (40.75°, 34.5°) as the ideal in diamond cutting. For over half a century the GIA, AGS and many others supported these angles as the pinnacle of light performance in the round brilliant. The belief was that round brilliant diamonds cut to these angles were the most beautiful, possessing the best combination of brilliance (brightness and contrast), fire (rainbow colours of dispersion) and scintillation (sparkle with movement).

In 1998 GIA startled the diamond world by withdrawing its former support for Tolkowsky's single angle combination, declaring that their research had shown that there was a range of angle combinations with as-good or better brilliance. The AGS, as well,



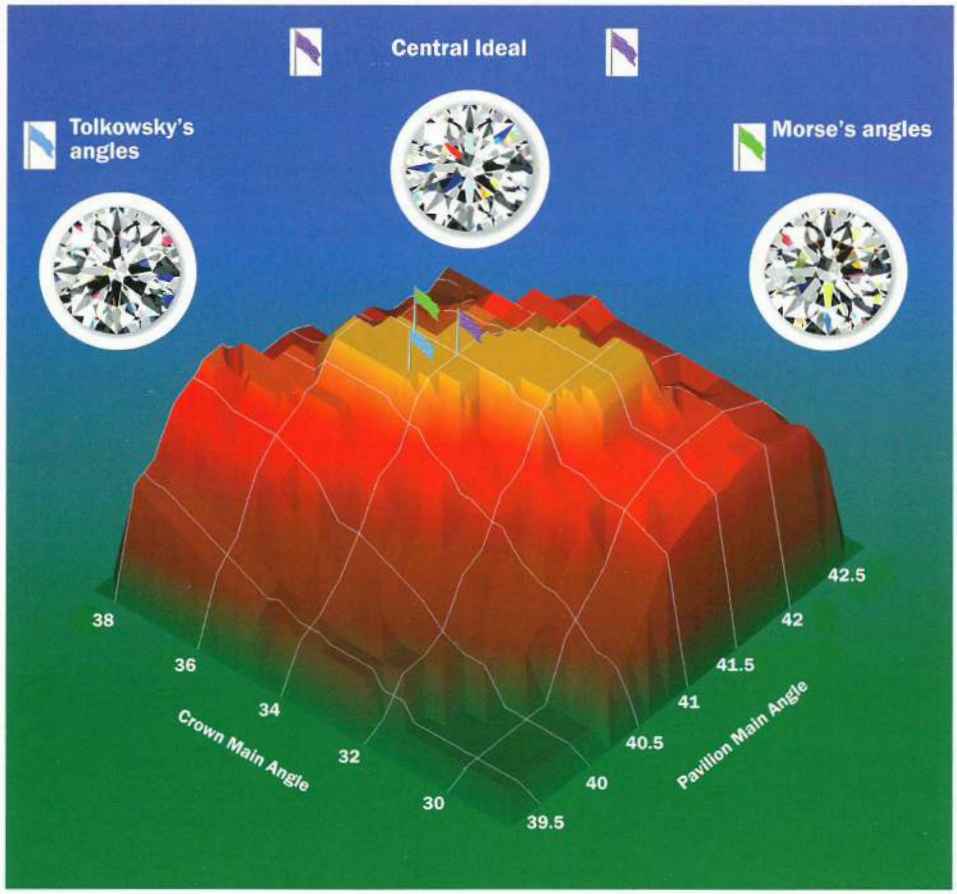
1: Graph of the 'sweet spot' plateaus of GIA and AGS showing the locations of the 'Central Ideal' and the Morse and Tolkowsky angle combinations.

found a range of angle combinations, though marginally different from GIA's, that displayed the Tolkowsky top performance. Others also found that, although the angles of Morse and Tolkowsky resulted in top performing diamond beauty, equally beautiful diamonds could be obtained over a range of angle combinations (**1**).

This range of angle combinations, what could be called a 'sweet spot' in round brilliant diamond cutting, ended the belief in an Everest-like single peak of light performance. This kind of image was instead replaced with what could more accurately be described as a 'peak plateau at the mountain top of diamond beauty'. Within this plateau or 'sweet spot' area there is ideal, top, but essentially equivalent, diamond light performance. The 'Central Ideal', unlike an Everest-like peak, is the target centre point of that plateau. The 3-D graph (**2**) illustrates the combined GIA–AGS 'sweet spot' plateau.

Like the 'sweet spot' in a tennis racket or golf club head, where the ball is struck with best effect, cutting within the 'sweet spot' range results in the diamond's best light performance. Shown in **1** and **2**, the range of this sweet spot plateau encompasses the pavilion and crown angles long associated with the 'Ideal' cut, those of Morse (41°, 35°) and Tolkowsky (40.75°, 34.5°). When the cutter fashions the diamond by aiming for the target centre and stays within the sweet spot range, the diamond responds with the best light performance and beauty.

The surprising discovery is that GIA and AGS, as well as cutters of the 'Ideal' and others, have almost identical centres to their respective sweet spots for table %, pavilion and crown angle (56%, 41° and 34°), even though the range of each varies in shape and extent. For instance, notice in the graph shown in **1** that the sweet spot plateau of the AGS 'Ideal 0' (the blue area) is a flatter, thinner ridge compared to the wider plateau of the GIA 'Excellent' (the yellow area). The author and many cutters of 'Ideals' have a still smaller sweet spot range around the Central Ideal that we find to be best. For example, from the 1970s the Institute for Technical Training in Antwerp, Belgium, taught angle combinations of 41° and 34° – 34.2° (Dirk Verbiest, pers. comm.). In



2: 3-D graph of diamond light performance and beauty.

the same time frame, but a continent away in Johannesburg, South Africa, the Katz Diamond Cutting Factory was teaching its apprentices to cut the Ideal Round Brilliant to a 41° pavilion main angle and a 33° to 35° crown main angle (P. Van Emmenis, pers. comm.). A conclusion reported by Cowing (2007, *The Journal of Gemmology*) was that diamond cutters were correct in their adherence to close to a 41° pavilion angle.

In **2** is a more vivid 3-D representation of the range of 'Ideal' that is in common between the ranges of GIA 'Excellent' and AGS 'Ideal 0' (the overlapping green area in **1**). This 3-D graph shows with coloured flags, the locations of the 'Central Ideal' and the Morse and Tolkowsky angle combinations.

This 3-D dipiction of light performance can serve as a guideline for cutters striving for top performance and maximum yield. A key observation is that according to the 3-D graph of GIA-AGS light performance (**2**), a diamond cutter could obtain equivalent light performance by moving to the right on the plateau to (41.5°, 32°). Not only is equivalent light performance indicated by both GIA and AGS, but cutting to either this combination or the 'Central Ideal' combination of (41°, 34°) enables greater weight retention from typical diamond rough than is obtained when cutting to Tolkowsky's theoretical angles. Top performance with greater weight retention from the rough crystal is a big win-win in diamond cutting.

The close agreement in the 'Central Ideal' location is true not only for the three diamond features of table size, pavilion and crown main angles, but also for all seven angles and proportions that make up the round brilliant cut. For the round brilliant, the finest or ideal beauty is attained in the narrow range of parameter combinations, around the 'Central Ideal', where this cut

The Central Ideal (continued)

3. Photograph of an Ideal Cut taken under contrasty, 'fire friendly', patchy blue sky.

4. 'Central Ideal' cut simulation in high contrast lighting with close-viewing, observer obstruction.

5. Photograph of an Ideal Cut taken under contrasty, 'fire friendly', spot illumination.

exhibits the best distribution of brilliance (in both its aspects of brightness and contrast), fire and sparkle. This is especially true of the 'Ideal' when viewed, not only in favourable lighting like that in **3**, **4** and **5**, but most importantly, in more usual illumination such as is found in homes and offices.

After considering the GIA and AGS sweet-spot parameter centres, along with the knowledge gained from his own research, the author concluded that the seven-parameter target 'Central Ideal' for the round brilliant, listed in order of importance is:

1. Pavilion main angle = 41°
2. Length of pavilion halves = 77%
3. Crown main angle = 34°
4. Table size = 56%
5. Star Length = 55%
6. Girdle size = thin to medium
7. Culet size = small to none

These proportions agree with those of many cutters of the 'Ideal' and diamond cutting institutions. They accord with the writer's knowledge of the parameters that result in ideal beauty in the round brilliant.

There remain important differences among the various cut-grading systems. Even within the sweet spot in common between GIA and AGS there are small, but observable differences in light performance. This is most apparent in less favourable illumination. When examining a diamond closely, the greater light obstruction from the observer's head and body affects the pattern of reflections seen. These differences in light performance lead to preferences, even within the top performance plateaus of GIA and AGS.

However, in the final analysis, close agreement is found in the target centre of best round-brilliant light performance, the 'Central Ideal'.

The Author

Michael D. Cowing, FGA, MS
AGA Certified Gem Laboratory
www.acagemlab.com

Details and a full exposition of the 'Ideal' in diamond cutting can be found in 'Accordance in round brilliant diamond cutting', *The Journal of Gemmology*, 2007, **30**(5/6), 320–30, which can also be found on the author's website at www.acagemlab.com/news/JoG07305.pdf.

Building Education for the Future

Meet Lorne Stather, Gem-A's new Director of Education

With the recent retirement of Ian Mercer, Gem-A's Director of Education for many years, Gem-A has appointed a new Director of Education and surprisingly it's me. But who am I? Let me introduce myself. My name is Lorne Stather and I have been working for Gem-A for over twelve years. I will admit I have been a background person for quite a chunk of that period, starting out as an assistant tutor and administrator and then over the years covering various roles from tutor to Course Developer and Director of Projects. It has given me the chance to see Gem-A from a range of different perspectives. But now, like an owl blinkingly looking at daylight, I am emerging from the background and submerging myself in the challenging role of Director of Education – and what a time to take on such a position.

With the recent launch of Gem-A's new on-line Foundation course which in turn involved the development of the course notes, there has never been a more exciting time for the education department. We are on the brink of a major step forward in the services we provide our students and members, and this Foundation course is just the beginning. This very well received new course will be followed in September with the launch of the new on-line Diploma course and again a whole set of new materials have been developed to accompany it.

These enhanced courses enable students to interact with tutors and other students from anywhere in the world whilst giving them the flexibility to study in their own time yet with the structure and support of a more formal education system.

These educational developments will benefit not only our students but also our members and the gem trade. The facilities and resources being introduced and developed now for our education services will create a solid core for Gem-A's continuous professional development programme. This programme is designed to keep those in the trade up-to-date with the information they and their customers need in an ever-changing market. One of the biggest challenges facing today's gem trade is finding new markets and opportunities as buyers become more cautious in their spending habits. By providing the best possible information to buyers and sellers, Gem-A can help to instil customer confidence and protect against costly mistakes.

As Gem-A enters its second century of gemmological education I will endeavour to continue this important and prestigious tradition whilst modernizing and improving the services provided to students, members and just as importantly the gem-trade as a whole.

NAJA Scholarship

All current students on a Gem-A Gemmology Diploma or Diamond Diploma course who are considering a career in jewellery valuation/appraisal, can apply for the National Association of Jewelry Appraisers (NAJA) scholarship to the 2010 NAJA National Conference to be held in Tucson AZ, 9–10 February 2010.

You will need to submit a 300–500 word essay about your reasons for wanting to become a valuer, due 1 November 2009. For more information and an application form see the NAJA website. http://www.najaappraisers.com/ScholarshipApp2010.pdf

Gem-A News and Views

Building Education for the Future (continued)

Read Award

Gem-A has introduced the Peter Read Gemmology Practical Award in memory of the late Peter Read (1927–2009). Peter had been a Gem-A correspondence course tutor for 25 years in addition to running a series of weekend practical courses for students taking Gem-A's Diploma examination. The Practical Award is particularly appropriate in view of the extensive work he had done on the development of gemmological instruments.

The new award will be made annually to the Gem-A Gemmology Diploma graduate with the highest achievement for the year in the practical section of the Gem-A Gemmology Diploma exams.

The first award will be made at the Graduation and Awards Ceremony to be held at Goldsmiths' Hall, London, on Monday 19 October.

Diamond Course fees held for 2009

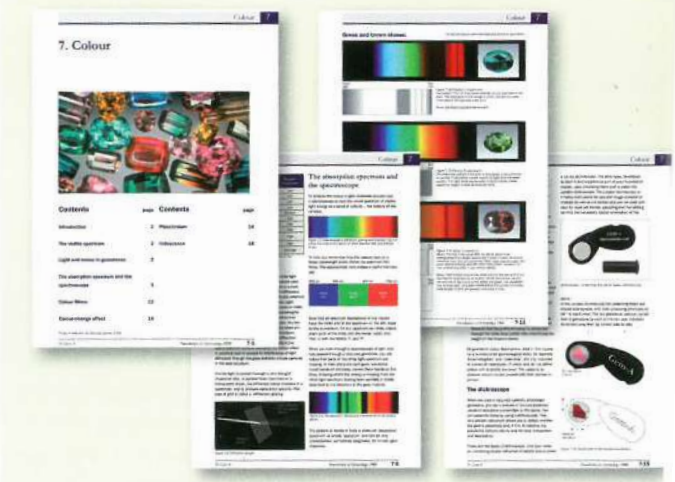
To reflect the difficulties being faced in recent months by the gem trade and the diamond industry in particular, Gem-A has chosen to show its support for the industry by freezing all its diamond course fees for 2009/10 at the 2008 prices.

To find out more about Gem-A courses and fees see our website www.gem-a.com

Great Foundation

The updated and totally 'new look' Gem-A Gemmology Foundation Course was launched last September and has been widely acclaimed. However, the proof of its success was always going to be its impact on enrolments and results. Although the new course is not yet fully adopted worldwide because of continuity and translation reasons — and despite the bad economic situation — January 2009 still saw the second largest number of people sitting Gem-A's January Gemmology Foundation exam over the last 12 years. The pass rate was 76% — slightly above the year-on-year average of 75%. Also revealing was the lowest ever drop-out rate between examination enrolment and the exam — just 9% compared with the previous year-on-year average of 16%. Gem-A is looking for even greater improvements in student numbers and pass rates as the new course, with its increased online student support, is more widely adopted in its international teaching centres.

The January 2009 Gem-A Gemmology Diploma exam also saw a high intake and the highest pass percentage for 12 years.



Pages from the new Gem-A Foundation in Gemmology course notes.

Pick up the thread

Gem-A will be repeating one of its more popular workshops in May providing gemmologists and bead-enthusiasts with basic threading skill Recent years have seen a huge increase in the popularity of beads, and a huge range of wonderful coloured stone beads at remarkably reasonable prices. But most then need threading. As many buyers have complained, it often costs more to have a necklace threaded than did to buy the beads. So Gem-A is delighted to help remedy this situation. Learn the art of bead stringing.

More information is given on page 2 and on the Gem-A website at www.gem-a.com/education/short-courses-and-workshops.aspx.

Gem-A News and Views

Building Education for the Future (continued)

Gem-A Diamond Scholarship Awards

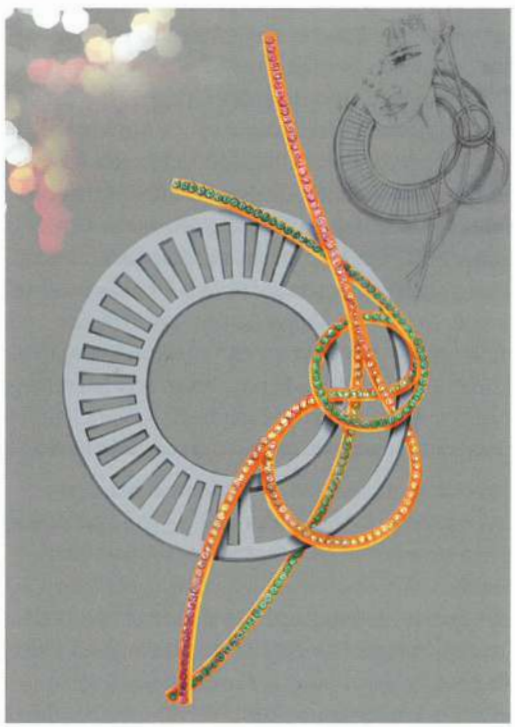
Congratulations to Phattra Maneerattanaporn and Rebecca Steiner, winners of the 2009 Gem-A Diamond Scholarships in the Craft and Design Awards. These annual Awards are organized by the Goldsmiths' Craft and Design Council as part of its programme to promote excellence amongst those engaged in the trade. Gem-A is pleased to continue its support for the future of the industry by awarding Practical Diamond Certificate courses as scholarships.

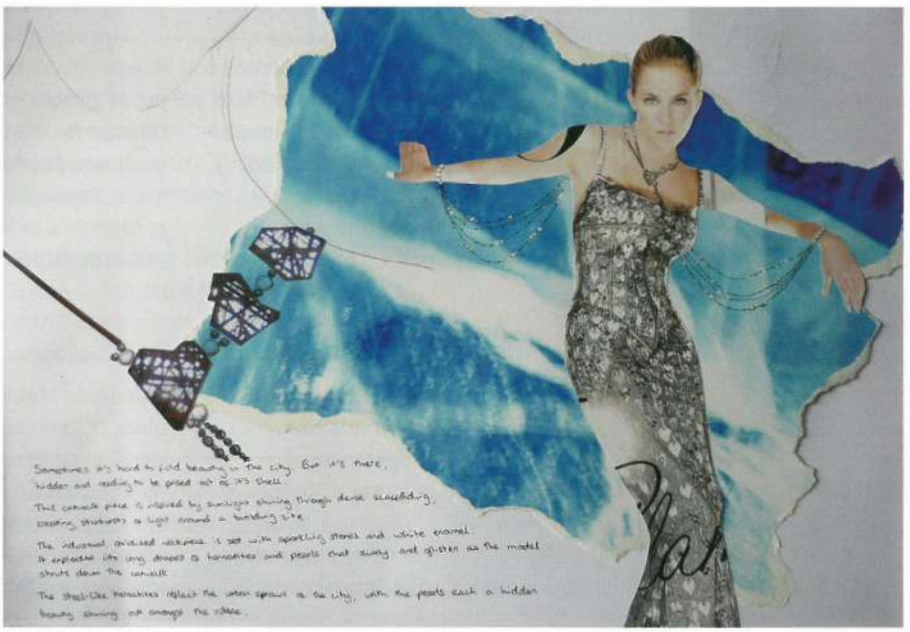
Phattra Maneerattanaporn is a BA Jewellery Design student at Central Saint Martins College of Arts and Design. Phattra's entry was a neckpiece designed for the catwalk that she had called 'The city that never sleeps'. Said Phattra: "I was inspired by the metropolitan night lights that glitter vibrantly in the city that never seems to sleep. The circular silver plate was used to express the rapid, continuous activities within the mega capital. In contrast, a modern material of acrylic plastic, along with crystals in traffic light colours, were used to signify the sparkle of the street lights at night." Phattra said that she is looking forward to taking the Diamond Practical Certificate course which will help her to fulfil her dream to "design diamond jewellery, obtaining the best quality diamonds for clients' commissions."

Self-employed jewellery designer Rebecca Steiner's entry was also a neckpiece, titled 'Glittering urban art'. "This catwalk piece is inspired by sunlight shining through dense scaffolding, creating starbursts of light around a building site," said Rebecca. "The oxidized neckpiece is set with sparkling stones and white enamel. It explodes into long drapes of hematites and pearls that sway and glisten as the model struts down the catwalk."

Although Rebecca uses diamonds frequently in her work, she admits to limited experience in grading and valuing the stones. "I want to be able offer a better, more informed service to my customers, and the Gem-A Diamond Practical Certificate course will give me the insight I need to offer a reassurance of quality to my customers and to push my business forwards. I am thrilled to be awarded a place, and am very excited about taking part in the course."

Scholarship winners Rebecca Steiner (left) and Phattra Maneerattanaporn at the 2009 Craftsmanship and Design Awards Ceremony held at Goldsmiths' Hall on 2 March.





The winning designs: ' The city that never sleeps' by Phattra Maneerattanaporn (left) and 'Glittering urban art' by Rebecca Steiner (below).

In the news

Pearl Dubai Pearl Forum

Jack Ogden speaking at the Dubai Forum.

Gem-A CEO Dr Jack Ogden took part in the World Pearl Forum (17–18 February 2009) as a guest of the Dubai Multi Commodity Centre (DMCC), a Dubai Government agency. The Forum was held in the astonishing surroundings of the recently opened Atlantis Hotel, Dubai, and consisted of a series of 29 presentations by pearl industry representatives over two very packed days. The purpose of the forum was to bring together experts from around the world to discuss the present state of the pearl and cultured pearl market, and to seek ways in which cultured pearls might be promoted. Dubai was the obvious venue for such an international forum because of the historic part Dubai had played in the pearl trade, and the recent establishment of the Dubai Pearl Exchange, a subsidiary of the DMCC.

The development and current state of the cultured pearl industry was explained in a series of talks by leading proponents — including Nicholas Paspaley (Chairman, Paspaley Pearls Group), Robert Wan (Chairman, Roert Wan, Tahitu), Noriyuki Morita (President, Mikimoto & Co. Ltd), Justin Hunter (J. Hunter Pearls, Fiji), Weizan Zhan (Chairman, China Pearl Group) and Bill Reed (MD, Linneys of Broome). Presentations on the future potential were given by, amongst others, Sonny Sethi (President, Cultured Pearls Association of America) and Hedda Schupak (Editor in Chief, JCK International Publishing Group).

There were also talks by Ken Scarratt (Director of GIA Research, Thailand) about the GIA's cultured pearl grading system and by Dr Taijin Lu (Chief Researcher, China National Gemstone Testing Center) on differentiating between different qualities of Chinese freshwater cultured pearls. Natural pearls were covered by Jack Ogden, David Bennet (Chairman of Jewellery, Middle East and Europe, Sotheby's), Ali Mohammed Safar (Director, Precious Metals and Gemstone Testing, Bahrain) and K.C. Bell (KCB Natural Pearls).

It was interesting to see how the natural and cultured pearl markets could be viewed as complementary. Pearls cover an amazin range from natural pearls worth millions of dollars, to fine South Sea Akoya and Tahitan cultured pearls to the ubiquitous, but often very attractive, Chinese cultured freshwater pearls. Natural pearls would always remain available only to the few, but without the existence, evocative history and aspirational importance of natural pearls, the cultured pearl market would not exist. A focus of the forum was the potential for the establishment of a single marketing and promotiona initiative to raise the profile of cultured pearls worldwide. Many participants believed that cultured pearls were placed to become an increasingly important part of the jewellery market worldwide and that generic marketing might help considerably.

The World Pearl Forum was also used to announce the Natural Pearls Course being developed by Gem-A for DMCC. This course grev out of discussions between Gem-A and Gaiti Rabbani (Executive Director for Coloured Stones and Pearls, DMCC) started when Gaiti was invited to the Gem-A 2007 Conference which had pearls as a major theme. DMCC also helped sponsor the Gem-A Pearl event hel at Christie's in September 2008 (see *Gems & Jewellery*, October 2008, page 28).

A Day of Colour and a Gem Party

The 2009 Gem-A Conference has been revised to be for one day only. Despite the enthusiasm for the format of last year's two-day conference, the current economic woes and tightening of belts everywhere have prompted us to reduce this year's planned conference to one day — Sunday 18 October.

The accent is on colour, with Gem-A's Chelsea Colour Filter a focal point in this its 75th anniversary year. Keynote speaker on the Chelsea Filter will be gemmologist, author and broadcaster Antoinette Matlins, famous as a great fan of this simple but vital piece of gemmological equipment. The Conference will be held at th Kensington Hilton. Go to www.gem-a.com for the latest information on the event.

A Gem Party on the Sunday evening open to all Gem-A members new graduates and their guests, will be held at the Kensington Hilto following the Conference.

Gem-A News and Views

Scot Free

The Scottish Gemmological Association is being formed to take over some of the role of what has hitherto been the Scottish Branch of Gem-A.

The Scottish Branch, re-established in 1995 after being dormant for many years, has become a highly active group with a variety of events including, of course, its annual conference which attracts participants from near and far and which is considered by gemmological cognoscenti as a not-to-miss experience. The write-ups of the conferences in past issues of this magazine give an idea of their excellence and coverage.

When Gem-A became a charity in 2005, the existing branch network needed to be reconsidered in the light of the fairly strict definitions of 'branches' in charity law. One significant consideration with regard to the Scottish Branch was that Scotland has its own charity regulations (last revised 2007) and Gem-A was only registered as a charity in England and Wales. There were various options, including registering Gem-A as a Scottish charity, but other complexities, including VAT and accounting requirements, made the easiest option the one of creating a new group, linked closely to Gem-A, but sufficiently autonomous of Gem-A to keep its day-to-day operations simple.

Brian Jackson, Chairman of the Scottish Branch of Gem-A, has said: "The last thing any of us wanted was to cut our ties with Gem-A. We needed to find a way in which a small but enthusiastic group of volunteers could operate efficiently, without being tangled up with charity regulations and VAT. I am delighted that Gem-A and we Scots have been able to begin to define a new association, one in which members can benefit from Gem-A affiliation whilst continuing to give a service to the Scottish gemmological community. The new organization will continue to promote Gem-A."

Dr Jack Ogden, Gem-A CEO comments: "The creation of the Scottish Gemmological Association seems to be an ideal way forward and I am happy that the discussions with our Scottish members have had such a positive result. I hope that what will be defined here might also be used as a template for other groups of Gem-A Members and Fellows worldwide."

The Scottish Gemmological Association will be formally inaugurated at the Scottish Conference (1-4 May). The name is provisional until consultation with appropriate Scottish bodies has been concluded as organizations that include the words 'Scottish' and 'Association' in their names can require approval.

Olga Gonzalez leaves Gem-A

Olga Gonzalez has left Gem-A following the expiry of her work visa (she is an American national). Although Olga only joined Gem-A in 2007, she rapidly became a well-known face at Gem-A events and Trade shows, her last such presence being part of the Gem-A team at Tucson in February. She planned most of Gem-A's centenary events in 2008, including the Centenary dinner and the Conference, and contributed to *Gems & Jewellery*, most recently the Tucson report in this issue.

Olga joined Gem-A following a year's internship at Goldsmiths' Hall, London, during which time she gained her MA in Art History. While at Gem-A she studied for, and passed, her gemmology Diploma. She is now back in New York torn between the call of the gem and jewellery world or returning to her previous career as an actress.

New to Las Vegas

Gem-A is bringing its popular 'Introduction to Practical Gemmology' workshop to Vegas to coincide with the JCK show. Take the opportunity to learn about the basic principles of gem identification and try gem-testing for yourself, under the guidance of Gem-A's senior instructor Doug Garrod FGA DGA. The workshop will be hosted at the headquarters of the American Gem Society (AGS) on Wednesday 3 June. (See page 33 for further details.)

What you've been talking about on MailTalk

Recent posts on MailTalk, the email-based forum that allows you to share comments and ideas with other members.

- My client wants to know why the diamonds I have acquired for him do not have faceted culets.
  MailTalk members not only gave the reasons why culets used to be faceted, but also advised that in some cultures it was believed that the luck contained within a diamond would run out if the culet was cut.
- Does anyone know what dye is used to produce dyed crackled quartz?
  It was concluded that many different dyes could be used. In some cases advanced gemmological techniques were necessary to identify the treatment.
- The AGL laboratory is reopening.
  Many of you expressed concern on the sudden closure of the AGL and welcomed the later news that it was to reopen under the ownership of Christopher Smith, former vice president and chief gemmologist of the AGL.
- What should we call a gemstone that has been created by Mother Nature and yet enhanced/treated at a later time?
  This question brought an enormous number of responses, many quite lengthy, and covering treated as well as synthetic diamond. For the latest information on the issue, see Harry Levy's 'Around the Trade' article on pages 12–15.
- In memory of Alain van Acker
  Tributes have been flooding in for Alain van Acker, a prolific contributor to MailTalk, following his sudden death on 23 March. We will miss you Alain, rest in peace.

For information on MailTalk and details of how to join go to www.gem-a.com/membership/mailtalk.aspx

England's largest diamond

The celebrated, but now lost, Pigot diamond has received a fair amount of attention in books and articles over the years, most recently in Lord Balfour's wonderful updated *Famous Diamonds*, but research continues to augment our knowledge. Today the Pigot comes way down on the list of the world's largest diamonds, but two centuries ago it was by far the largest diamond in Britain.

Part 1: The Gamble

It is unclear exactly how the great diamond known as the Pigot* Diamond came into the hands of Sir George Pigot (1719–1777) while he was a somewhat controversial British Governor of Madras for the East India Company, but it was not the first large diamond to find its way into private British hands in India, nor the last. The stone was almost certainly in Sir George's possession when he returned to Britain from India in 1764, and indeed in 1800 it was described as having been in the Pigot family for 36 years. It cannot have first arrived in Britain after he revisited India in 1775 and died there, imprisoned, in 1777, because in 1776 the scientist Benjamin Wilson mentions he had examined the stone in England

Sir George brought the diamond back to England as a rough stone or, perhaps more likely, 'native cut'. In either case, it was soon cut to suit European fashion, probably in London, then a major diamond cutting centre. According to one report this cutting of the Pigot Diamond took two years and cost three thousand pounds. The final weight of the cut stone has been variously reported, but the 'official weight' was 47.38 ct. This suggests that the original rough cannot have been much under 100 ct. For those unable to visualize 47.38 ct, one early-nineteenth-century observer helpfully tells us that this is "about as large as two thumb nails". It was cut as a fine, oval brilliant, but "objected to by the connoisseurs as not having sufficient depth". There were lead models of the Pigot Diamond in the British Museum, before cutting and at various stages during the cutting, but these have not been located so far.

Benjamin Wilson notes the approximate weight of the diamond as "200 grains" in 1776. There were then four diamond grains to a carat, thus making the weight about 50 ct, close enough to the 47.38 ct to show that it must have been cut by the time he examined it.

We shouldn't underestimate the Pigot; at the turn of the nineteenth century it was the largest diamond in Britain. The second largest was reportedly a diamond of 36 ct in the possession of the Hornsby family. Nothing now seems to be known about this stone, but perhaps it should be linked with William Hornsby, who had been president of the council of the East India Company at Bombay in the eighteenth century, and equally controversial — he had allegedly "acted in a manner repugnant to the honour and policy of this nation, and thereby brought great calamities on India".

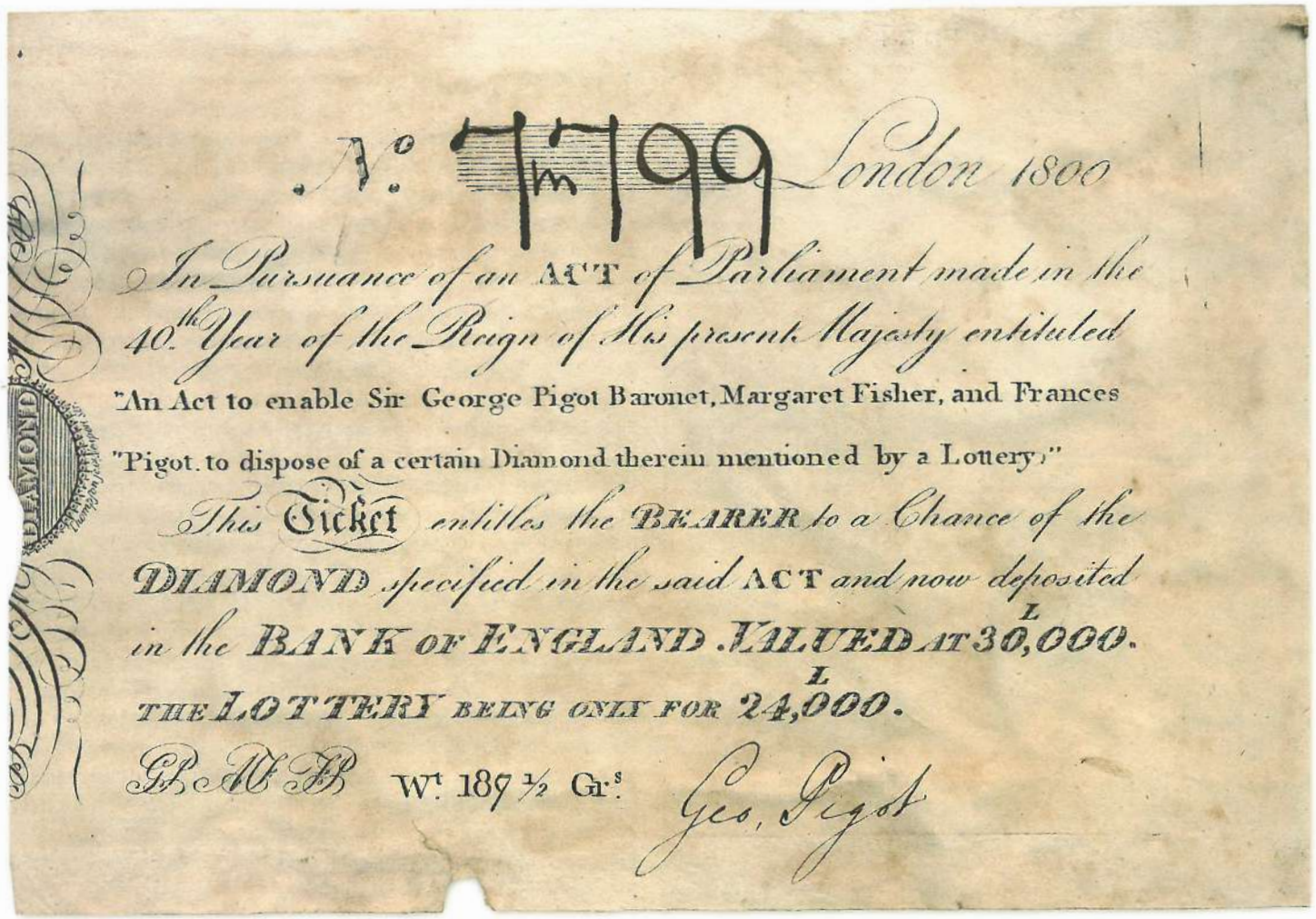
In 1777 Sir George Pigot died, unmarried but with several illegitimate children. The diamond, along with his other possessions, was left to his brothers, Sir Robert Pigot (who found fame in the American War of Independence — he commanded the left flank of the British assault in the Battle of Bunker Hill) and Admiral Hugh Pigot, and his sister, Margaret. When the brothers died (in 1796 and 1792 respectively) their shares passed to Robert's son George Pigot and Admiral Pigot's widow Frances and five children.

These joint owners attempted to sell the diamond, as perhaps had their predecessors, but without success. "No Individual hath yet been willing to purchase it; whereby the several persons interested therein [the owners] have, for a great number of years, lost all benefit and advantage which they otherwise would have derived therefrom, had the same been sold and disposed of." It was too big and expensive for any one buyer and the highest offer they had received was £11,000 — less than half, if not a third, of its perceived value. As another commentator noted: "There was no one ready, for the possession of a thing, which could only gratify taste by its beauty, and vanity by its rarity ..."

It is hard to imagine that Sir George Pigot's heirs were in desperate need of money — Benjamin Wilson noted that Lord Pigot had also shown him other gems including 'a large brilliant drop', 'a large yellow diamond, and 'a very large pearl'. But his will, written in 1775 just before his return to India, had given them permission to sell, and that is obviously what they wanted to do.

* Here I have used the spelling Pigot with one 'g' as this was used by Sir George Pigot himself and by other eighteenth-century writers. By about 1800, 'Piggot' had also appeared and both are used, seemingly indiscriminately, from then on, even in Parliamentary reports. Even 'Piggott Diamond' is sometimes encountered.

Gem and Jewellery History



A surviving example of one of the tickets for the 1800 lottery for the Pigot Diamond.

Photo of a twentieth century 'replica' of the Pigot diamond. Copyright Gem-A.

Drawing of the Pigot Diamond from John Murray, A Memoir on the Diamond, *London 1831.*

Gem and Jewellery History

England's largest diamond (continued)

The ingenious way to realize the true value of the diamond was by lottery. Such a move, however, required the consent of Parliament. A petition was presented to Parliament in February 1800, and permission for the lottery then wound its way through the various stages in the House of Commons and the House of Lords. Experts were called, including the jewellers Thomas Jefferys, James Watson and Philip Gilbert, who all attested to the excellence and value of the stone.* Arguments for the lottery included the plea that one of the owners (presumably Admiral Pigot's widow), was old and might die at any time. Should she do so, her share would pass to under-age children, and the stone could not be sold until they came of age. The Earl of Westminster pointed out that the original intention had been to give the diamond to the Crown, but "circumstances did not allow this". Opposing the lottery was the Duke of Norfolk who feared that such a lottery might create a precedent and encourage "every person who had acted on similar mercantile speculations in India to come to Parliament and expect at the hands of the legislature a means of profitably disposing of their bargain". Others worried that it might draw much needed funds away from the State Lotteries.

Despite the objections, the Bill was agreed and on 2 July 1800 there was the publication of "An Act to enable Sir George Pigot Baronet, Margaret Fisher and Frances Pigot, to dispose of a certain Diamond ... by a Lottery." A total of 11,428 consecutively numbered tickets could be sold at 2 guineas each making £23,998.16s the maximum sum that could be realized (a guinea was £1.1s). This barely compares with the values placed on the stone by experts, which ranged from "£25,000" to "cheap at £30,000". There were other stipulations. The diamond would be the only prize in the lottery prior to the lottery the diamond would be deposited in the Bank of England, and any costs involved in the lottery would be payable out o the revenue from the sale of the tickets.

Advertisements for the lottery began to appear in the British press in August 1800 stating the value of the Pigot Diamond at "near thirty thousand pounds". As a comparison, the State Lottery tickets on sale at the same time had two first prizes of £30,000 cash each. The tickets were available from various stockbrokers and other companies in London, and through various agencies outside London including newpaper publishers and jewellers, the latter also advertising that they had models of the Pigot Diamond on display. For an extra sixpence per ticket a purchase could be 'registered' thus advising the winner "the earliest intelligence of their success". A surviving lottery ticket is illustrated, possibly the only such survivor, which gives the weight of the stone and bears George Pigot's signature. This ticket was originally in the possession of the Pigot family.

Perhaps the most curious selling pitch for lottery tickets appeare in *The Oracle and Daily Advertiser* on 18 November 1800, a sort of early version of an astrology column: "The Goddess Fortune at the same time that she recommends the Pigot Diamond to the patronag and protection of the Ladies in the Imperial Dominion of Britain; declares likewise that it shall be given to the Fairest who of them would not therefore adventure the trifle which purchases a ticket in the Lottery for the Superb Jewel when the fortunate she who obtains it, will not only excel most of her competitors in Fortune but also All them in Beauty as the Deity above mentioned has declared."

England's largest diamond (continued)

By December 1800 the firm of Hornsby & Co., in their many advertisements for lottery tickets, began to add a note of an earlier success — they had sold the winning ticket in the only previous lottery for diamonds — the 'Diamond Prizes in Cox's Museum Lottery' in 1774, also held by Act of Parliament. These diamonds were a pair of pear shapes, part of James Cox's amazing museum of fantastic objects and jewelled automata. Just why a previous lucky success might influence the next is unclear, but in gambling, logic and statistics are often forgotten.

As the date of the draw drew nearer, potential purchasers were told to buy soon because there was a limited number of tickets for sale and were reminded that they "cannot purchase tickets during the drawing". There was Pigot lottery fever. In a letter seemingly written to Lady Hamilton, Lord Nelson had said: "Pray, as you are going to buy a ticket for the Pigot Diamond — buy the right number, or it will be money thrown away."

The draw took place on 2 March 1801 at Guildhall, London, using the State Lottery wheel. By then "there was not a ticket to be got at any price" (although a later report suggests that maybe not all tickets had been sold). It was an exciting event — and crowded. One unfortunate person present had his pocket picked of the then huge sum of £300. The winning ticket was number 9488. The lucky winners — winners in the plural because the ticket had been bought in shares by 'four young gentlemen' — were John Cruikshank, stockbroker of Birchin Lane, London; Richard Blanchford, lace manufacturer, Exchange Alley, London; John Henderson of the London stock exchange and William Thompson of Walworth. The mother of one of these fortunate young men "became so elated at the intelligence of her son's success, as in a very short time to shew the most alarming symptoms of insanity".

And, despite the odds, the wining ticket for the Pigot Diamond had been sold by Hornsby & Co. They gleefully reported this fact in their advertisements for state lottery tickets for several years.

One can imagine the celebrations that night — young men have not changed much in two hundred years. And imagine the disappointment of the eleven thousand or so losers. As one humorist later said: "Fortune was ever kind to me, and you may remember the Pigot Diamond lottery, I was within two of the fortunate number."

No doubt the four young winners' heads were not entirely clear when they awoke the next morning, but it cannot have been long before a very worrying question hit them. The Pigot family had been unsuccessful in trying to sell the diamond for almost forty years, so how would these four men ever be able to realize the riches that had so providentially come into their hands?

To be continued ...

Jack Ogden

* The reports of these jewellers were covered in an earlier article by the present writer, in the distant ancestor to this publication, *The Newsletter of the Society of Jewellery Historians*, 11, June 1981.

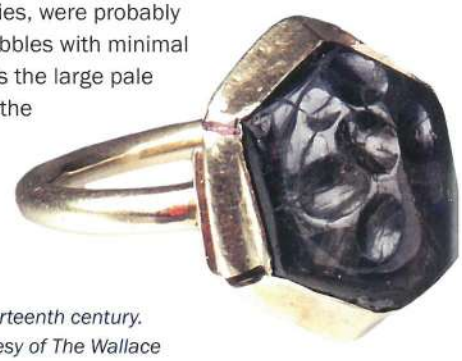
Treasures of the Black Death

It is sad irony of fate that the opening up of the silk route across Asia with the 'Pax Mongolica' in medieval times greatly increased European access to gem materials, but also facilitated the spread of the bubonic plague. This plague, now called the Black Death, killed perhaps a half of Europe's population during the 1340s. No cause or cure was known and the plague's death toll was soon augmented by the killing of many thousands of European Jews following rumours that they had started the disease by poisoning wells.

The exhibition 'The Treasures of the Black Death' at the Wallace Collection, London, brings these interrelated events together in two important hoards of jewellery, including ornaments set with gems, buried for safety at the time of the Black Death and, most probably, by Jews. One of these hoards was discovered in the old Jewish quarter of the German city of Erfurt in 1998 and comprises in excess of 600 gold and silver ornaments, as well as a huge number of silver coins and 14 circular silver ingots. Erfurt had a significant Jewish community in medieval times, but after the Black Death struck in 1349 1000 Jews were killed in a single day. The magnificent Jewish gold wedding ring in the hoard reinforces the suggestion that the hoard was owned by Jews or related to their business.

The second hoard, which also includes a Jewish wedding ring, is from Colmar in France where it was found in 1863. It is a smaller hoard, but similarly from the Jewish quarter of the town and was almost certainly concealed in 1349 during the massacre of the Jews there.

The ornaments in the two hoards bear remarkable similarities, witness to their similar dating and the general homogeneity of jewellery forms and techniques across northern Europe at that time. The gemstones set in the ornaments are typical of the period and include sapphires (of characteristic pale blue colour and almost certainly from Ceylon) rubies (from Ceylon or, by that period perhaps Burma), garnets, turquoise and pearls. Clearly sapphires were then more abundantly available than rubies, but remarkably we find both gems set in gilded silver ornaments as well as the far more costly gold. Most of the gems are simple cabochon forms, but some of the sapphires retain some vestiges of their hexagonal shape and, like the rubies, were probably polished water-worn pebbles with minimal shaping. An exception is the large pale sapphire in a ring from the Erfurt Treasure (**1**) (Cat. no. 21) which in addition to retaining a hexagonal outline



1. Ring, second half of thirteenth century. Gold and sapphire. Courtesy of The Wallace Collection © Erfurt treasure, TLDA.

has depressions polished with an abrasive wheel, presumably fed with diamond powder. This was to remove disfiguring flaws in and on the stone and is a simple stone-cutting technique that we see on sapphires in jewellery from at least as early as the seventh century AD. As this technique is encountered in early medieval times in the Mediterranean world, in Islamic jewellery and even in seventh-century China (see *Gems & Jewellery*, December 2004, page 93), it is likely that the work was carried out in Ceylon itself. It is not impossible that later medieval instances of these 'dimple-polished' sapphires reflect re-use of gems from earlier ornaments.

Relatively sophisticated faceting was also beginning to appear in European jewellery by this time, again most typically improving on the natural, flattened hexagonal form of water-worn sapphires. Examples in the present exhibition are limited to the hexagonally faceted garnet in the centre of a gilded silver brooch from the Colmar treasure (**2**) (Cat. no. 34) and, perhaps, two of the garnets in a brooch from Erfurt (Cat. no, 29a).

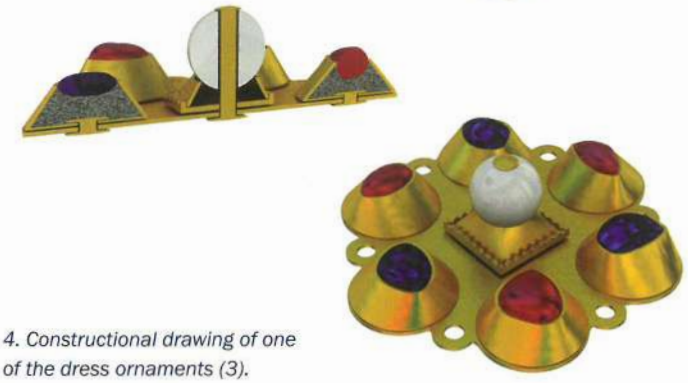
The varied shapes and sizes of the gems set in the jewellery raise the obvious questions about how the settings were made. The most characteristic setting of the period takes the form of a sheet gold (or gilded silver) truncated cone or pyramid. The setting is filled with a bedding material, the stone pressed into place and the top edge of the setting lightly burnished down around the stone edge. The nature of the filling materials in medieval gem settings has not to my knowledge been investigated, but where the fillings are exposed due to the loss of a stone, they appear to have an earthy or clay-like texture (and seemingly this is not always just infill from centuries of burial). The more sophisticated fillers that we encounter in Renaissance and later jewellery do not seem to have been recorded in earlier centuries. In some cases the whole shape of the setting is matched to the stone. Thus the square-shaped gem on one brooch from Erfurt (Cat. No. 29c) is in a pyramid-shaped setting, the circular stones in conical settings. In other cases the settings all have the same circular base, but their top openings have been distorted to take the available gems. This can be seen, for example, in a pair of gold and gem-set dress ornaments from Erfurt (**3**) (Cat. No. 58). One of these ornaments is also reproduced in the constructional drawing in **4**, which illustrates the typical assembly of such jewellery.

In some cases the settings have claws or 'prongs'. This was perhaps most characteristic with the larger stones, or where the gem's shape would not allow sufficient security in a simpler setting. The claws are simply D-section gold wire soldered to the sides of the setting and pressed over the stone.

A few notes on the technique might be useful here. First of all, as the constructional drawing shows, gold jewellery was typically made from numerous components, most frequently thin sheet gold cut and bent into relatively simple forms that could be soldered together. Often several soldered components were then joined together or to a base-plate by means of rivets. This type of mechanical joining minimized the need for sequential soldering operations. In medieval times, gold and silver jewellery was soldered by almost a 'firing' operation – by placing it in a small furnace or over charcoal. The flame and blowpipe approach to soldering was a later technique –

2. Brooch, second quarter of fourteenth century. Silver gilt, sapphires, rubies, garnets and pearls; 3.7 cm square. Courtesy of The Wallace Collection © Colmar treasure, MNMA.

3. One of two dress ornaments, late thirteenth/ first half of fourteenth century; 2.5 cm diameter. Gold, sapphires, almandine garnets and pearls. Courtesy of The Wallace Collection © Erfurt Treasure, TLDA.



4. Constructional drawing of one of the dress ornaments (3).

Gem and Jewellery History

Treasures of the Black Death (continued)

and one that revolutionized jewellery manufacture.

The objects that are stamped appear generally to have been stamped into metal dies, not created with a punch or pressed over a former. The designs and their sharpness suggest that the sheet gold was formed into the dies with a wax, lead or pitch 'force'. Matched 'male' and 'female' counterpart pressing equipment was a later introduction.

Gold jewellery was seldom if ever cast, but silver was often cast and several of the ornaments in the exhibition are of cast, and usually gilded, silver. A certain degree of mass-production can be seen here – such as the near-identical fleurs-de-lis in the Erfurt Treasure (Cat. No. 56c). Their slight variations in sharpness and edges suggests that these may have been made by the lost wax casting technique using a series of wax models which had been produced by pressing wax into a mould, although direct casting of silver into the stone moulds may have been used or even sand casting. The latter would be interesting as the technique is mentioned in an Islamic source in the early thirteenth century but not documented with certainty in Europe before the late fifteenth century.

Many of the silver ornaments are enamelled as well as gilded. Enamelling and gilding using the mercury or 'fire gilding' process are both operations requiring heat and thus had to be carried out in the right order. Components would first be soldered together, if required, then enamelled, then gilded.

The catalogue does have two chapters on the technical aspects. One tantalisingly called 'Goldsmiths' Techniques' is just a fraction of a page long and sheds no useful light on the subject. The other section by Oliver Mecking is 'Scientific Examination of the Treasures'. In fact this deals solely with the analysis of the silver alloys and solders encountered in the treasures, but this is useful, albeit esoteric information, supporting other work in demonstrating the relatively higher grades of silver used for the enamelled silver items and those that were stamped rather than cast. The table of solder compositions used on the silver objects in the two hoards and in other silver finds is also valuable, and supplements other published analyses and recipes from medieval texts. Unfortunately the short references cited in these two technical sections are not elucidated in the bibliography.

The catalogue is a must for anyone interested in medieval European Jewellery – whether or not they are able to visit the exhibition itself. It is copiously illustrated with fine photographs, has a selection of essays on the background to the two treasures and detailed descriptions.

The present author's chapter on 'The technology of Medieval Jewelry' (one of the works referenced in the Catalogue but not listed in the bibliography) can be found online at http://www.getty.edu/conservation/publications/pdf_publications/ancientmetals2.pdf

Jack Ogden

The exhibition is on at the Wallace Collection, London, until 10 May 2009. Further details are given at http://www.wallacecollection.org/collections/exhibition/72

The catalogue *Treasures of the Black Death*, edited by Christine Descatoire (ISBN 9780900785955) is available from the Wallace Collection and booksellers.

Blinding Bling

Humorous and satirical newspapers have a long history — and sometimes long names. One seventeenth-century periodical, published by John Crouch, had the wonderful title *Mercurius Democritus, or, A true and perfect nocturnal, communication wonderfull news out of the world in the moon, the Antipodes, Tenebris, Fary-land, Egypt, Green-land, and other adjacent countries*. Published for the right understanding of all mad-merry-people of Great-Bedlam. The issue for 22 December 1652 had a piece about jewellery (I've kept the period spelling):

"The Queen of Sweden have sent the King of Scots a Jewel more precious then the world, it is about the bigness of a cabbage, and set in a Gold Ring as circular as the spheres [planets] , round about are set Emrauds, Saphyrs, Jaspers, Calcedons, Topazes, Chrysophasists, Jacynthists and Amethysts, and all the rest of the Pearls and Precious Stones that belong to the Crown, which Jewel gave so bright a lustre to the Emperor and the Duke of Saxony, that with the radiant beams thereof (shining round about them) they became as blinde as Moles..."

It is unclear if there is any deeper significance here. Kings of England had also been kings of Scotland from the time of James I of England (James VI of Scotland). There was no King of England in 1652 – this was the time of Cromwell — but the man later to ascend the throne of England as Charles II of England in 1661 had been crowned King of Scotland in 1651 although he fled to France the same year.

Law quartz

One of the difficulties we have in insisting on 'correct' gem descriptions in the UK is the lack of good legal precedent. Gem descriptions are seldom seen as serious enough to warrant police or Trading Standards time, when there are dangerous electrical equipment or unsafe children's bikes to sort out. In the jewellery industry, about the only jewellery-related areas that attract legal attention are hallmarking infringements and violations of designers' intellectual property rights. So at Gem-A we are trying to assemble what gem-related court-cases we can find. An early one was that involving Paul de Lamerie cited in the last issue of *Gems & Jewellery*. Here is a more recent one. In 1969 Morecambe Magistrates Courts fined a jeweller for 'the misdescription of goods'. Among the goods he was offering to the public were quartz being sold as topaz, paste described as topaz, synthetic corundum described as alexandrite and synthetic spinel being sold as aquamarine.

That same year the Gem-A council discussed whether it was correct to use the term 'Cairngorm' to describe brown or smoky quartz and decided that it was better to use the latter terms, "even though Cairngorm might not be considered to indicate origin of a stone". The Cairngorms, of course, is a mountain range in Scotland where this type of quartz is found. The minutes of the Council meeting merely say that "Various legal opinions were noted". Sadly the opinions themselves cannot be traced.

Filter trips

The Chelsea Colour Filter is celebrating its 75th birthday this year, but over that long period I am unaware that anyone has questioned the chemical composition of the glass used ... until now. When a Chelsea Colour Filter was recently sent to a gemmologist in Iran, a request was received by Gem-A asking for the chemical composition of the glass. It is unclear exactly what the fear was.

Radiance

The article about the irradiation of gemstones, especially topaz, in *Gems & Jewellery*, June 2008, pages 8 and 9, was intended to allay some of the fears that had been expressed in the media about gems being radioactive and thus dangerous. One of the commonest irradiated gems is blue topaz and indeed natural blue topaz is rare indeed. So we were interested to see a 2001 magazine article on gem therapy which a reader had encountered (presumably in a doctor's waiting room); this tells us that "blue topaz emits blue cosmic rays which have a soft satisfying effect. It is said to make us more open to creative inspiration and playfulness." (*Better Nutrition Magazine*, February 2001). Were the US Nuclear Regulatory Commission aware of this when they introduced their new regulations on the distribution of irradiated gems in 2007?

Jack Ogden

Errata

In the review of *Ancient and Modern Gems and Jewels in the Collection of her Majesty the Queen* in the last issue of *Gems & Jewellery*, the important work of Nigel Israel and Christopher Cavey in the identification of the gem materials also should have been mentioned.

Salesroom News

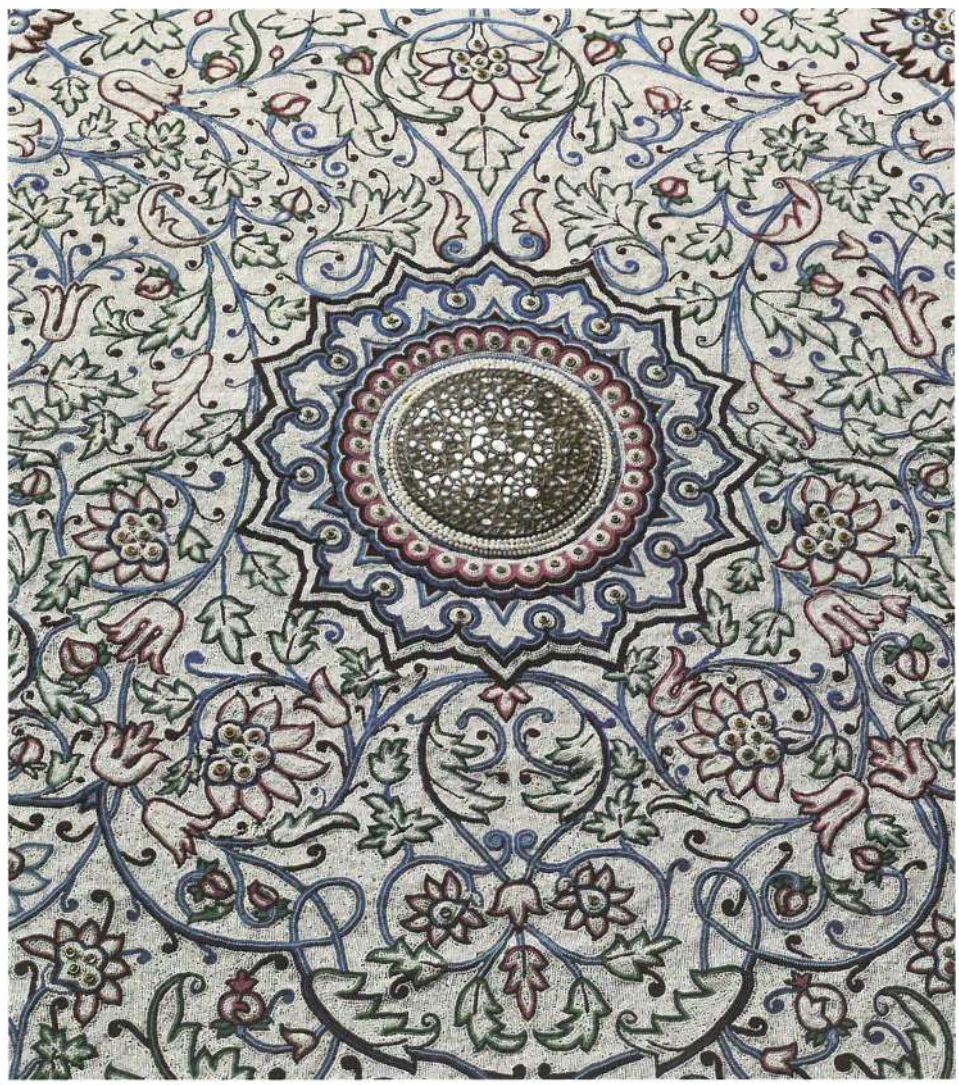
The Pearl Carpet of Baroda

This magnificent carpet, embellished with an estimated two million natural seed pearls, sold for nearly US$5.5 million, a world record for a carpet, at Sotheby's March sale in Doha.

A carpet traditionally believed to have been created as a gift for the tomb of the Prophet Mohammad in Medina and commissioned by 'Gaekwar' Kande Rao, the Maharaja of Baroda, formed the centrepiece of Sotheby's inaugural series of sales in Doha on 19 March. The intended gift was clearly never delivered as the Maharaja died before he made the donation and the carpet therefore remained in his family.

The surface of the carpet is entirely embellished, created by using an estimated two million natural seed pearls known as 'Basra' pearls, socalled because they had originally been collected from the waters of the Persian side of the Gulf. The design of the work echoes many of the details found in Safavid and Mughal carpet designs with dense fields of swirling flowering vines that here form a deconstructed series of three Mughal-style arches. The design is picked out in coloured glass beads and the whole richly encrusted with hundreds of gold-set diamonds and precious stones.

Whilst this commission appears to have been unique, parts of the design reflect eighteenth-century India's fashionable millefleurs motif. Across the centre there are three large round 'rosettes' each made of table cut diamonds set in silvered gold.



A section of the Pearl Carpet of Baroda showing one of the three central motifs.
Photo © Sotheby's.

Salesroom News

Further smaller diamond rosettes appear in the border, all of which are embellished with sapphires, rubies and emeralds set in gold.

It is widely reported that when he commissioned the work, the Maharaja wanted to create a carpet that would be suitable for the tomb of the Prophet Mohammad in Medina. These reports suggest that he wanted it to cover the tomb in a way that echoed the tomb of Mughal Empress Mumtaz Mahal in the Taj Mahal. On the death of the Maharaja the carpet entered the family collection where it remained for over 100 years, a testament to the splendour and opulence that surrounded the Maharaja and his court.

Exhibited in 1902–3 as a highlight of the great Delhi Exhibition displaying the wealth of the Maharajas, the carpet was later moved to Monaco with Maharani Sita Devi – the 'most flamboyant Maharani' – who took the carpet along with her jewellery collection when she moved to the Mediterranean. The carpet was again showcased in the 1985 landmark exhibition 'India' at the Metropolitan Museum of Art in New York.

Detail of the carpet showing the pearls, glass beads, diamonds and other precious gems. Photo © Sotheby's.

Auction Houses

Listed below is a selection of British-based auction houses specializing in jewellery. Visit their websites for details of forthcoming sales.

Bonhams	**www.bonhams.com**
London, Knightsbridge	020 7393 3900
London, New Bond Street	020 7447 7447
Edinburgh	0131 225 2266
Los Angeles	+1 323 850-7500
New York	+1 212 644 9001
San Francisco	+1 415 861-7500

Christie's	**www.christies.com**
London, South Kensington	020 7930 6074)
London, King Street	020 7839 9060
Amsterdam	+31 (0)20 575 5255
Dubai	+971 (0)4 425 5629
Geneva	+41 (0)22 319 1766
Hong Kong	+852 2521 5396
Milan	+39 02 303 2831
Beverly Hills	+1 310 385 2600
New York	+1 212 636 2000

Fellows & Sons	**www.fellows.co.uk**
Birmingham	0121 212 2131

Lyon & Turnbull	**www.lyonandturnbull.com**
Edinburgh	0131 557 8844
Glasgow	0141 333 1992
London	020 7930 9115

Sotheby's	**www.sothebys.com**
London, New Bond Street	020 7293 5000
Geneva	+41 (0)22 908 4800
Milan	+39 02 295 00201
New York	+1 212 606-7000
Hong Kong	+852 2524 8121

Woolley & Wallis	**www.woolleyandwallis.co.uk**
Salisbury, Wiltshire	01722 424500

Events and Meetings

Gem-A Annual General Meeting and

LALIQUE'S GEMS

As seen in the collections of the Calouste Gulbenkian Foundation

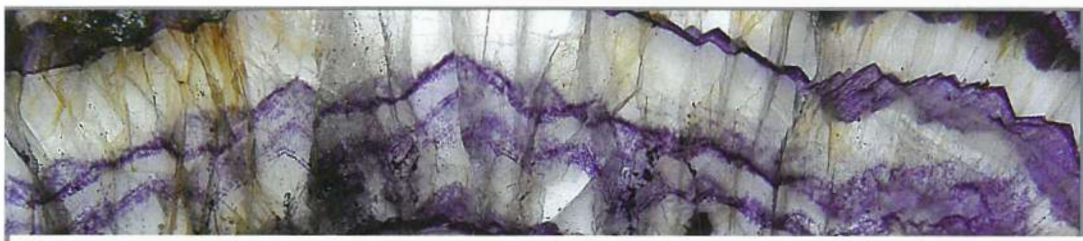
by RUI GALOPIM DE CARVALHO FGA DGA

Monday 22 June 2009 at 5:45 for 6:00 pm
The National Liberal Club, Whitehall Place, London SW1 2HE

The AGM will be followed by a presentation by our guest speaker, Rui Galopim de Carvalho, of the Gemological Laboratory in Portugal (LABGEM).

René Lalique (1860–1945) is justly famous for his jewellery and glasswork, but little has been said previously about his gemmological preferences. In this lecture, Rui will use the extensive Lalique jewellery collection of the Calouste Gulbenkian Foundation in Lisbon as the starting point for his investigation into this fascinating subject. Lalique's choice of gems was influenced not only by the aesthetic movement and the market availability of the period, but also by his ingenuity and originality as an artist. The talk will also introduce those less familiar with the Gulbenkian Foundation to the masterpieces by Lalique within its collections.

Visit our website from Monday 1 June for further information on the meeting and to download the AGM Agenda, annual report and accounts. Hard copies can be mailed to members on request.



Gem-A Conference 2009

*** Sunday 18 October – The Hilton London Kensington**

Showing Colour
To celebrate 75 years since the introduction of the Chelsea Colour Filter, presentations will look at colour in gems, its causes and effects. Keynote speaker will be ANTOINETTE MATLINS.

Gem Party

Sunday 18 October – The Hilton London Kensington

A party, to include dinner, to which all members, students and their guests are invited, will follow the Conference.

Gem-A Graduation Ceremony

Monday 19 October – Goldsmiths' Hall, London EC2

* Please note that the Conference is now to be one day and not two days as previously announced (see page 28).

Go to www.gem-a.com for the latest information on these events

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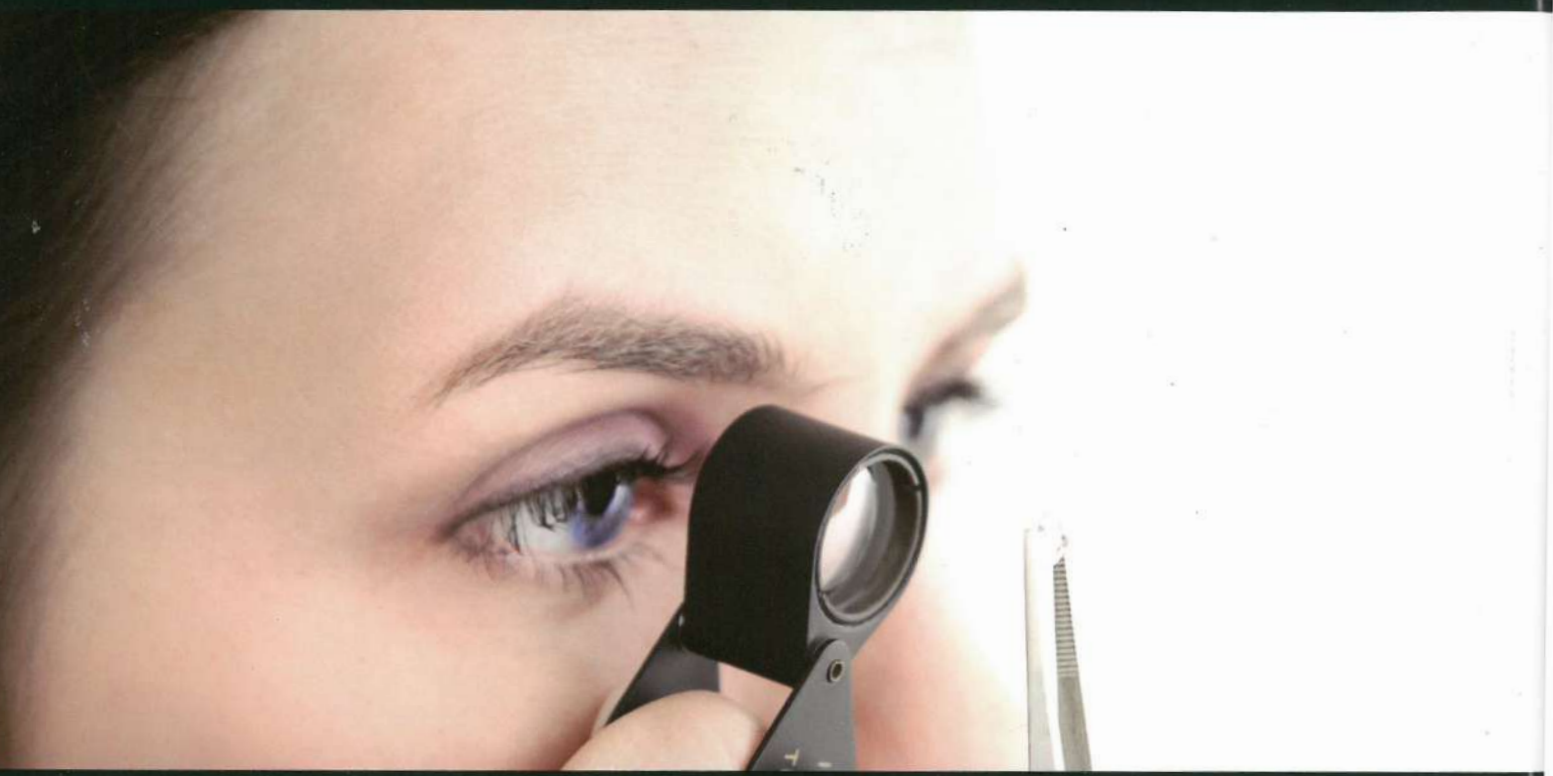

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