Gems & Jewellery

March 2006 Vol. 15 No.1

The Gemmological Association of Great Britain & The Society of Jewellery Historians

Peak performance

We have just completed a detailed statistical analysis of the thousands of diamonds that we have graded in our laboratory over the last three years. We now know that the average diamond that passes through the lab for grading is a 1.74 carat, G colour, VS2 brilliant cut. More noteworthy is the clear indication of how market demands lead cutters to tease the weights up to round numbers of carats. A plot of the weights of stone we grade show remarkable peaks at carat weights of 0.5, 1.0, 1.5, 2.0, 2.5 and so on, even up to 10 carats.

One of our Bond Street clients recently described the Gem-A laboratory as the 'Harley Street' of gem labs. (For the non-UK readers Harley Street is the area traditionally associated with the elite of medical practitioners and surgeons.) The balancing act is to retain the excellent aspects of our traditional approach – hand-plotted clarity charts, for example – with the best of the new. Among the latter is cut grading for round brilliants, using the recently introduced GIA criteria. This is something that we now offer as an option. A few years ago there was huge resistance to diamond cut grading among many in the diamond industry. But over the last few years, and to a large extent through on-line sales, the public awareness of 'certs' and thus weight, colour and clarity, has greatly increased. The trouble is that with human nature and the laws of economics being what they are, you are tempting problems if you base diamond pricing on the 'four Cs' but quantify just three of them. We are great believers in diamond beauty being in the eye of the beholders and have huge reservations about objective cut grading. But when you have a public demanding certain weights, clarities and colours, the less reputable diamond sellers will inevitably maximise their margins by offering stones where symmetry and proportions leave a lot to be desired. So in a sense cut grading will help protect the customer and the dealer who has his or her customers' best interests at heart.

Will the diamond market in its collective marketing hat – from glossy magazine ads to discount interest sites – begin to make the public more aware that symmetry and proportions play major roles in the appeal of a diamond? If they do, then the peaks in our weight statistics at round carats and half-carats should begin to smooth out over the coming years.

Jack Ogden
Chief Executive Officer, Gemmological Association

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Gems&Jewellery

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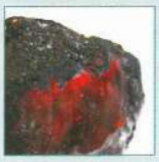
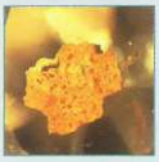
Gold and Chalcedony Brooch by John Donald, 1966. 18 ct gold looped wires, part-polished, part-textured with granulation of gold filings, with natural chalcedony. See Precious Statements, p.7.



Fake rough ruby. See Hands-on Gemmology, p.11.



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Titanium brooches by Ann Marie Shillito. See Jewellery, p.16.

Uncertainty continues

HARRY LEVY takes a look at issues affecting the diamond trade today

I have recently attended two Diamond Congresses. The first was a meeting of Presidents of the World Federation of Diamond Bourses (WFDB) last November in Mumbai, and the other was a meeting of the World Diamond Council (WDC) at the beginning of February in Catania in Sicily.

One of the main issues in Mumbai was the disruption to the supply of rough diamonds caused firstly by a change of policy by the DTC towards its Supplier of Choice Sight Holders, and secondly by BHP, Rio Tinto, Alarosa and the Lev Leviov Group not having any clearly defined system of passing their rough diamonds into the supply chain. The regular suppliers claim that any stockpiles they had of larger stones have been sold, and they now supply the market with goods which come in from their new mining and production. The situation in the traditional markets has been further exacerbated by demands from China and India for their home markets, as more and more can afford to buy such stones locally.

The trade has had an abundance of small stones for a number of years, as both Argyle and Alarosa sold goods to India, when De Beers could no longer buy their total productions. The Indians became over-stocked, brought prices down to attract customers and improved the quality of their goods. There have been very large demands in both China and India itself for these small stones, as they both continue to manufacture jewellery to supply western demands for cheap diamond jewellery.

Both these situations have resulted in price increases across the board, but the increases have not been uniform. All those in the supply chain have a built-in resistance to buying, and those selling are holding out for better prices. To compound this resistance to business there is the continued attack on the trade by some of the NGOs over Conflict Diamonds.

The issue of conflict diamonds was the main item at the WDC Congress. The WDC was set up during the WFDB Congress in Antwerp in July 2000. The story about the conflicts in Sierra Leone and Angola had become news, mainly through the work of Global Witness who publicised horrific pictures and stories from these countries where civil wars were raging. These included pictures of African amputees and civilian deaths said to have been brought about by the rebels, who were able to conduct the war by financing it through the sale of diamonds. The NGOs were trying to stop the sale of these diamonds by canvassing governments and the United Nations, and generally bringing the whole trade in diamonds into disrepute.

The diamond trade decided to tackle the issue in a positive way and formed the WDC to include leaders in the diamond trade representing the WFDB, International Diamond Manufacturers' Association (IDMA), CIBJO, government officials and officials from those conflict areas in Africa as well as the main rough diamond distributors. The term being used at the time was 'Blood Diamonds'. These were diamonds obtained by the rebels and sold to the cutting centres, bypassing the official government agencies. Discussions had started earlier in Kimberley in Africa and the WDC became one of the main parts of the Kimberley Group.

Kimberley set out to regulate the diamond trade by controlling the flow of diamonds from the conflict areas. This was government-led and eventually the Kimberley Process (KP) was set up. Its regulations were endorsed by the United Nations and the Security Council. Anyone trading in rough diamonds had to go through the KP and obtain certification for every parcel of rough moving between countries. They had to establish the legitimacy of their goods and the stones they were buying and selling. Anyone trading in other diamonds, known as illicit diamonds, was now potentially subject to international laws and penalties.

Countries that traded in rough diamonds, either as producers or processors, had to enrol into the KP. Initially there was confusion, and some countries were unable to join as this restricted trade and these countries feared contravening World Trade Organisation (WTO) rules. To show how seriously the movement of diamonds was now taken, these countries had to modify their laws to accommodate the KP. There are over fifty countries in the KP, although this number changes, as some members who are unable to show that they are adhering to the KP principles are expelled, and new ones are trying to join. The EU is treated as one country within the KP.

We thus have the KP which is government led and the WDC which is trade led. Both met regularly until the Process was established and now meet at least once a year. There is an overlap of members in both organisations and they work closely together. The KP has set up a monitoring system to check that the KP is working, with visits by a panel of officials, traders and NGOs going round the various diamond trading centres. The chairman of the KP serves for a limited period and the African countries that have diamonds are well represented.

Many believe that the initial conflicts in Africa have now been resolved, but some feel, particularly some NGOs, that conflicts have moved to other parts of Africa and stones are smuggled from these areas to countries that are monitored by the KP. Thus both the KP and WDC continue to play a role in regulating the diamond trade. Countries who have now fallen foul of the KP are the Ivory Coast (Cote d'Ivoire) and the Republic of Congo (ROC) in which there are now civil wars.

The NGOs continue to complain that not enough is being done, although they are represented in both the KP and WDC, as

well as within countries involved in the diamond trade. The trade has set up a system of warranties to ensure that polished diamonds as well as jewellery are now warranted to ensure that they are 'conflict free'. Amnesty International has just put out a new report complaining that conflict stones still come into the legitimate trade and such reports are always taken up by the media. On 10 February Amnesty International UK and Global Witness launched a guide to tell UK shoppers what they need to know when they shop for diamond jewellery, so that they can best ensure that they buy diamonds that are conflict-free. This followed an Amnesty International survey of 330 UK high street shops which is said to have revealed a poor awareness. According to this survey "Nearly a half (46 per cent) could not provide a copy of their company policy on conflict diamonds" and only 38 per cent of sales people said that they had received training about conflict diamonds (see Gem-A MailTalk 10 February 2006).

There will be more media attention soon. As noted in the last issue of *Gems & Jewellery* (p.96), a new blockbuster film is to be released called 'Blood Diamonds' starring Leonardo DiCaprio. It deals with the conflict in Sierra Leone in 1999 and is reported to link diamonds to the atrocities carried out there. If that is not enough, a recent track from rapper Kanye West called 'Diamonds from Sierra Leone' included a remix of part of Shirley Bassey's 'Diamonds are Forever', and the video was described as a "skewed version of the De Beers' diamonds commercials" with a shot of blood flowing from a woman's ring finger after she agrees to get married.

The diamond trade thus continues to be attacked on this issue, although it co-operates closely with governments and civil society – far more so than most other industries with similar problems.

Diamond grading

As if the attacks from outside the trade were not enough, the trade is still reeling from the allegations rocking the Gemological Institute of America (GIA). The GIA is known for its grading of diamonds as well as being an educational institute in the jewellery industry all over the world. Their grading procedures were questioned when grades for colour and clarity for some large important diamonds were thought to be too good and were challenged. The GIA was faced with a multi-million dollar lawsuit. It traced the questionable grading to a few of its employees – who are now no longer employees. The lawsuit was settled out of court.

An unrelated problem about grading reports has also surfaced in several diamond centres. It appears that forged GIA and other certificates are being produced which again give better grades for stones. The GIA have countered this by putting on a website copies of certificates they have produced. So if one logs in the number of the GIA report one can see if it matches the information they have on their report.

I am sorry much of the above does not make happy reading but I believe that it is always better to be in a position of knowing rather than remaining ignorant, especially if one depends on buying and selling diamonds for a livelihood. ❑

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Fabergé and the Russian jewellers

Gems and jewellery of the 18th to early 20th centuries, including pieces from the Russian crown jewels, to be displayed at Wartski's May exhibition

The sapphire and diamond dress ornaments **(1)** belonging to Elizabeth Petrovna, daughter of Peter the Great, will be amongst the earliest jewels included in Wartski's May exhibition 'Fabergé and the Russian Jewellers'.

A pair of sapphire and diamond dress ornaments belonging to Elizabeth Petrovna, daughter of Peter the Great. Private Collection.

An extraordinary range of materials and styles are apparent in Russian jewellery made between 1750 and 1917, and a representative selection has been brought together in Wartski's show, the first ever devoted to Russian jewellery. The wealth of mineral deposits in the vast Russian Empire was keenly exploited by Catherine the Great, who charged mineralogists far and wide to scour it for rare and valuable gemstones. Amethysts of unparalleled intensity, and pink and blue topazes were discovered in the Ural mountains. An Imperial ruby and diamond-set spray and diamond-set dress ornaments are on loan from the Victoria and Albert Museum, while a lavish suite of amethysts and a pink topaz, gifts from Alexander I to the Marchioness of Londonderry in 1821, have been reunited for the first time.

A selection of uncut gems from Siberia and the Urals will be lent by the Natural History Museum and juxtaposed with cut and polished examples mounted by the Imperial jewellers Bolin and Fabergé. A series of diamond-set brooches given by four Tsarinas to their ladies-in-waiting are in the form of their respective monograms. A brooch in the form of a crown is one of a small series commissioned from Fabergé for the highest-ranking Grand Duchesses, to mark the coronation of Nicholas II in 1894. This particular example was made for Elizabeth Feodorovna, the sister of the Tsarina, and at 5250 roubles sold for a higher price than several of the Imperial Easter eggs.

Apart from jewels incorporating Russian gemstones, others of Russian inspiration but not necessarily Russian manufacture will be on view, including two tiaras in the form of kokoshniks created in London and Paris. Russian metalworking techniques were also influential as demonstrated by Lacloche's use of simulated 'petit point' work in a brooch and frost motifs on a bracelet. Jewels by Fabergé's contemporaries including Lorié, Bolin and Denisoff & Uralsky will show how the art nouveau style was interpreted in Russia.

An aquamarine and diamond brooch by Fabergé given by Tsarevitch Nicholas to his fiancée Princess Alix of Hesse, c. 1894. Private collection.

Research in Russia has unveiled startling provenances for certain pieces. Chief amongst them is an aquamarine and diamond brooch **(2)**, a gift from the Tsarevitch to Princess Alix of Hesse before their marriage in 1894. Another discovery is a pair of oviform cufflinks given by Marie Feodorovna to her son Nicholas II, decorated with enamel and diamonds. They were given to mark Easter 1907. This very pair is recorded in an inventory made by Nicholas II of his own collection of jewellery. Of all the jewels in the show perhaps these are the most poignant of all.

A rock crystal and diamond-set ice pendent by Fabergé, shown against its original design, 1913. Wartski, London.

Amongst the last of the pieces, representing the swansong of Fabergé's work as well as the last days of the Tsars, are ice-cold rock crystal and diamond-set confections in the form of icicles and frost-dusted pendants of unparalleled poetry and sophistication **(3)**. ❑

Katherine Purcell

The exhibition is to be held at Wartski's, 14 Grafton Street, London W1S 4DE, from 10 to 20 May 2006, from 11 am to 5 pm (closed Sundays). Entrance £8 including catalogue, in aid of the Samaritans. For further information visit www.wartski.com

Bejewelled by Tiffany, 1837-1987

Gilbert Collection, Somerset House, London WC2
24 June to 26 November 2006

Some 180 pieces from the Tiffany Archive, together with a small selection of jewels lent by private collections, will chronicle Tiffany's first 150 years. The exhibition will follow a broad chronological framework within which the pieces will be arranged thematically, highlighting particular designers, sources of inspiration or the materials favoured at different times during the 150 years covered.

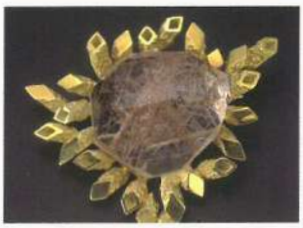
The exhibition will be accompanied by a catalogue with essays about aspects of Tiffany's history by jewellery historians.

Further information:
www.gilbert-collection.co.uk

The Tiffany Yellow Diamond Brooch. Diamond cut 1878, 128.54 ct, setting by Jean Schlumberger (1907-1987). Gold, platinum, diamonds, ruby. Photo: Craig Cutler.

Precious Statements

Goldsmiths' Hall, London EC2
19 May to 1 July 2006



18 ct gold brooch, heavily textured solid and hollow square rods and tubes cut at an angle to create diamond shape, echoing crystalline structure of the rutilated rose quartz. By John Donald, 1967.

The original creations of two of Britain's leading master-craftsmen will be on exhibition at Goldsmiths' Hall this summer. The works of the two artists, the jeweller John Donald and the silversmith Malcolm Appleby, reveal extraordinary talents, not only in terms of quality and the precious materials used but also in their exceptional creativity, individuality and attention to detail.

Silver and gold beaded bowl by Malcolm Appleby, 1988.

Further information:
www.thegoldsmiths.co.uk

The Road to Byzantium: Luxury Arts of Antiquity

Hermitage Rooms, Somerset House, London WC2
30 March to 3 September 2006

A collection of classical Greek, Roman and Byzantine luxury objects from The State Hermitage Museum, St Petersburg, will be exhibited including exquisite cameos, finely decorated gold and silver, and Athenian red-figure vases. These objects tell the story of the development of art and civilisation from 6th century BC Greece to the Middle Ages, and they overturn familiar assumptions about the period.
The Road to Byzantium explores the remarkable phenomenon of the longevity of ancient classicism.

The exhibition will be accompanied by a catalogue which will include essays by international scholars.

Further information:
www.hermitagerooms.org.uk

Alexander hunting boar, sardonyx, 1st century AD. © State Hermitage Museum

The Art of the Rockface: The Fascination of Stone

Norwich Castle Museum & Art Gallery: 22 May to 3 September 2006
Millennium Galleries, Sheffield: 23 September 2006 to 7 January 2007

This exhibition examines ways by which artists have explored the geology of the land in their quest for truth, and the fascination of stones and their meaning as an expression of man's place in the universe. The exhibition is divided into six thematic sections and, although the emphasis is on paintings and photographs, gems, jewellery and rock specimens are also featured. The main rationale for choosing jewellery for this exhibition has been the importance of the gemstones. Stones and gems have always been valued by humankind, for reasons beyond the obviously aesthetic or monetary. Personal, magical/talismanic, curative or symbolic reasons have been important. The jewellery in this exhibition aims to show the wide range of meanings which have been assigned to stones, across different times and cultures.

Further information on the venues may be found at
www.museums.norfolk.gov.uk
and
www.sheffieldgalleries.org.uk

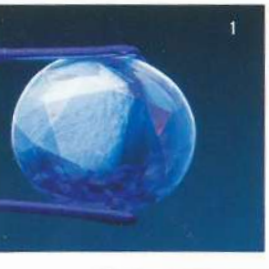
Heat seeker: UV fluorescence as a gemmological tool

RICHARD W. HUGHES and JOHN L. EMMETT explain how a simple LW/SW lamp can be used to indicate whether a stone has been heat treated

One of the greatest challenges gem dealers and gemmologists face today is being able to determine accurately if a stone has been heat treated. While a 100% reliable answer to that question is a job for a major gem lab, there is a simple and inexpensive tool that can often give an important indication.

So what is this miracle tool? We speak of the lowly ultraviolet (UV) light. It wasn't long ago that UV fluorescence was considered the poor stepchild of the gem lab, a pint-sized pea shooter when compared with the high-calibre cannons available in modern labs. But with the rising importance of treatment detection, the humble UV lamp is making a comeback.

Many heat-treated rubies and sapphires will display chalky short-wave (SW) fluorescence. This reaction is rarely found in untreated corundum and was first noted by Robert Crowningshield (1966, 1970). It is actually the colourless portions of the stone that fluoresce (a reaction similar to Verneuil synthetic sapphires). Since colourless areas follow the original crystal's growth structure, the fluorescence will follow the same pattern as the gem's colour zoning. Photos **1–4** and **9–10** illustrate this in both blue and pink sapphire and in ruby.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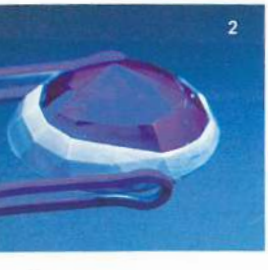
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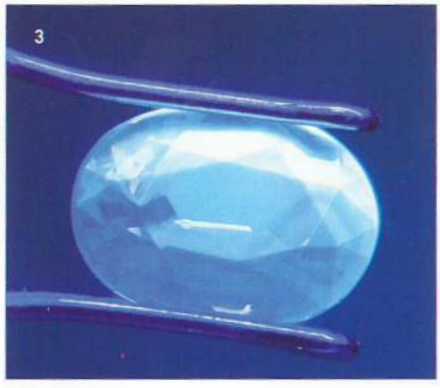
When a sapphire is subjected to high-temperature heat treatment, a chalky blue to blue-green SW fluorescence is often created. As shown in **1**, this reaction is confined to certain zones in the gem. These 'tufted' fluorescent zones follow the crystallographic structure of the gem. Flipping over the same sapphire reveals a distinct blue chalky fluorescent ring **(2)**, corresponding to the colourless portions of the gem when viewed in immersion. When seen, this strong chalky blue SW fluorescence is an extremely strong indication that the gem has been subjected to high temperature heat treatment. Another example of zoned chalky SW fluorescence in a heat-treated sapphire is shown in **3** and flipping over the same sapphire reveals a change in the fluorescent zoning pattern **(4)**, corresponding to the colourless portions of the gem when viewed in immersion. Note that this fluorescence often appears in patterns that resemble the graining of wood.

So how does one go about checking for this reaction? The first step is to obtain a combination LW/SW lamp. You will also need a pair of protective glasses (SW light can burn your eyes with prolonged exposure). A viewing cabinet is also a plus. Finally, you will need a small lens to magnify the stone. When observing fluorescence, the idea is to hold the stone with tweezers and bring it as close as possible to the lamp and view it under magnification. Examine the stone from all angles; many times the key chalky areas are confined to tiny portions of the stone. A set-up for close-up examination of UV fluorescence is illustrated **(5)**. A small piece of Blu-Tack or clay inserted between the UV lamp and the viewing cabinet creates a small gap. This allows the stone to be viewed while positioned extremely close to the lamp, greatly increasing the ability to catch weak reactions. A lens is positioned to magnify the stone during viewing and the masking tape keeps the lamp from tipping off the cabinet. Special UV protection glasses such as those in front of the cabinet should be worn to protect the eyes from harmful SW radiation.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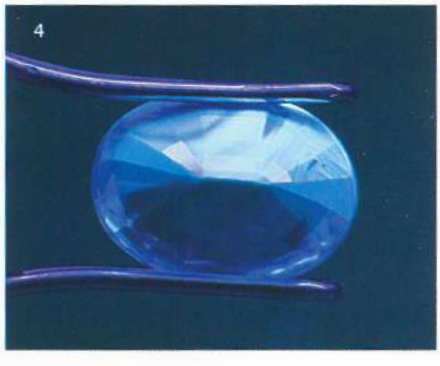
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This test does require a bit of knowledge. If a ruby or sapphire shows a chalky fluorescence in SW, it is probably heat treated. If it is inert, that does not mean


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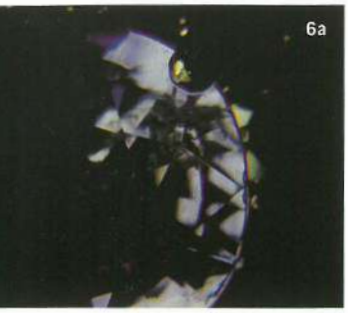
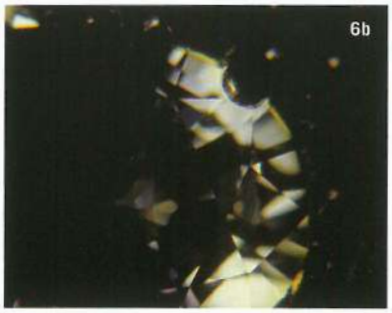




it's unheated. Also be careful that the stone is clean. Soap and other chemicals can also produce chalky fluorescence. And while this test is a tool that can be extremely useful, it is not a substitute for a complete gemmological examination in a fully-equipped laboratory. Finally, keep the exposure times of corundum to SW fluorescence to a minimum. SW irradiation does create a yellow colour centre that can alter the colour of the gem; even five minutes exposure can do this. While this colour fades with prolonged exposure to daylight, it can give a blue stone a green tint (not good if it's your stone and you're trying to sell it).

The illustration above **(6)** shows a blue sapphire **(6a)** in a ring; the same stone following a few minutes irradiation by SW UV **(6b)**. This yellow colour will fade with exposure to sunlight, but illustrates how one should not expose corundum for prolonged periods to SW UV.

Breaking down fluorescence

In its most basic sense, fluorescence is the emission of visible energy of a longer wavelength when bombarded by energy of a shorter wavelength. The stimulating energy may be X-rays (X-ray fluorescence), ultraviolet light (UV fluorescence) or even visible light. Ruby provides an excellent example of the latter.

When a ruby is put into daylight, certain electrons are excited to higher orbitals, producing absorption of the corresponding wavelengths. But instead of falling straight back to the ground state, the electrons fall in steps. In most cases, the release of energy from each of those steps is in the form of phonons to the crystal lattice (vibrational heat) and thus invisible to the human eye. But in the case of ruby, some emissions fall into the red (at 692.8 and 694.2 nm). This is what makes ruby so special; not only does it possess a red body colour, but that red body colour is supercharged by red fluorescence. This is what led the ancients to believe ruby had a fire burning inside.

UV fluorescence can be an extremely sensitive indicator not only of trace impurities, but also the conditions under which the gem formed. Indeed, it is not unusual for fluorescence to be easily seen from strongly fluorescing ions at concentrations around 0.01 parts-per-million (ppm). For lay-people, that's an itsy-bitsy amount, completely beyond the detection limits of all but the most sophisticated and expensive analytical equipment.

While the red fluorescence of ruby is detailed in many gemmological texts (cf. Hughes, 1997), the cause of the chalky fluorescence has not been covered. Let's take a look at it. Sapphire generally shows no fluorescence to visible light. But that changes if we expose it to SW UV. This is most clearly seen in synthetic colourless sapphire, which displays a bluish white chalky emission in the range of 410–420 nm.

Synthetic sapphire

This blue fluorescence in synthetic sapphire has been observed at least since 1948. While it has been generally ignored in the gemmological literature, it has been the subject of numerous scientific papers (cf. Evans, 1994). Evans surmised after reviewing the data that the 410–420 nm fluorescent peak was due to Ti^{4+} charge-transfer transition. That was later confirmed by Wong, *et al.* (1995a and 1995b). Isolated Ti^{4+} ions or Ti–Al vacancy pairs produce this fluorescence.

The Ti^{4+} charge-transfer transition in corundum is so strong and the efficiency so high that the fluorescence is easily observed by eye at even just 1 ppm Ti^{4+}. Most of the synthetic sapphire on the market contains at least one ppm of Ti^{4+} from the Al_2O_3 starting material, if not more, and thus fluoresces. The fluorescence peaks at about 415 nm at very low Ti^{4+} concentrations, but as the concentration increases, the fluorescent band broadens and the peak shifts to as high as 460 or 480 nm, making the fluorescence appear more greenish blue or whitish blue. Why this chalky fluorescence occurs relates to the growth temperature and Ti^{4+} concentrations relative to other impurities. In synthetic corundum, the high growth temperatures and high Ti^{4+} concentrations produce the chalky fluorescence. In certain heat-treated sapphires with low Fe levels (such as those from Sri Lanka), high-temperature heat treatment creates similar conditions to the synthetic. Thus the chalky fluorescence.

Natural sapphire

But what about natural, untreated sapphires? Why don't they fluoresce blue or bluish white? The reason relates to growth temperatures and time. Natural sapphires grow at much lower temperatures, so Ti^{4+} is much less likely to pair up with Al vacancies. These lower temperatures also allow easier pairing of Ti^{4+} with other ions (usually Fe^{2+} or Mg^{2+}) that prevent fluorescence. Another damper is the presence of Fe^{3+}, which also kills fluorescence. And finally, as the crystal sits in the ground for millions of years, diffusion slowly takes place, allowing the Ti^{4+} to pair up slowly with other ions, thus killing the fluorescence.

Heat treated sapphire

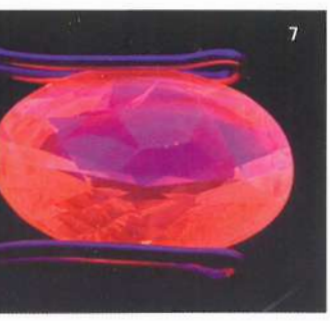
Why then, do some heat-treated blue sapphires fluoresce chalky blue to green or white, and what causes the difference in appearance? When blue (or *geuda*) sapphires are found in nature, they usually contain exsolved rutile. Titanium is concentrated in these rutile micro-crystals. When the stone is heat treated, the rutile dissolves into the corundum by diffusion, but because diffusion is slow, the local concentration of Ti^{4+} can be quite high. In the high concentration regions the Ti^{4+} concentration will exceed the local charge compensators (Fe^{2+} or Mg^{2+}) and thus free Ti^{4+} ions will form. In addition, the dissolution of rutile will locally force the creation of some aluminium vacancies and

Material	Impurity Levels	Growth Temperature	Growth Speed	Chalky SW UV Fluorescence
Synthetic sapphire	Low	High	Fast	Chalky
Natural sapphire	Various	Low	Slow	Inert
Heat-treated sapphire (low Fe type)	High Ti relative to Fe	Initially low; high during treatment	Slow; fast during treatment	Chalky in zones
Heat-treated sapphire (Fe-rich type)	Low Ti relative to Fe	Initially low; high during treatment	Slow; fast during treatment	Inert

some of the Ti^{4+}–Al vacancy clusters will form. These types will fluoresce and thus some heat-treated sapphire will fluoresce somewhat like synthetic Ti-bearing sapphire. Because the original distribution of rutile (and iron in solution) occurred in zones, the distribution of the fluorescence will reflect that zoning. The fluorescence will be most intense where Fe is lowest and Ti^{4+} is highest, i.e. in areas of minimal colour. The high iron-content basaltic sapphire (such as that from Australia, Thailand, etc.) will not fluoresce after heat treatment, as the iron concentration is much higher than the Ti^{4+} concentration everywhere. All of the above is summarised in the table above.

The technical bit

The appearance of chalky fluorescence in a corundum depends strongly on both the Ti^{4+} and Fe^{3+} concentrations. Considering Ti^{4+} first, it is important to note that the charge-transfer absorption in the UV per ion is extremely high. If we look at the fluorescence of a piece of synthetic sapphire with several ppm of Ti^{4+}, it seems to glow blue throughout its volume. This is because the total Ti^{4+} charge-transfer absorption is low enough that the UV photons can penetrate into the bulk of the sample. When the Ti^{4+} concentration is higher, the fluorescence seems to be coming from a thick layer near the surface because that is as far as the UV photons can penetrate. At high Ti^{4+} concentrations, only a thin surface layer is penetrated by the UV and the fluorescence appears as a chalky surface layer **(7)**,**(8)**. The charge transfer absorption of Fe^{3+} is also very high. Thus iron will contribute to limiting the penetration of UV into the sample also. Thus the very different appearance of the fluorescence of some synthetic sapphire and some heat-treated natural sapphire is not a different phenomenon, just a difference in impurity concentration.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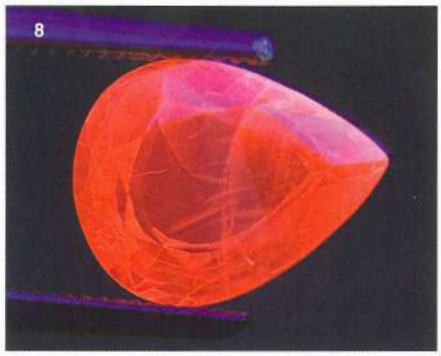
One of the authors (JLE) has used a Schott BG-12 filter to heighten the superficial chalky fluorescence often seen in heat-treated ruby. This filter eliminates the red fluorescence and transmits the Ti^{4+} blue fluorescence.

Two heat-treated and flux-healed rubies from Mong Hsu, Myanmar, are illustrated **(7)**,**(8)**, displaying thin, zoned patches of chalky blue fluorescence floating on top of the chromium-based red body fluorescence. These chalky blue zones are a strong indication of high-temperature heat treatment, but are masked by the red fluorescence and so hard to see.

A green Schott BG-12 filter was placed over the ruby shown in **(8)**, which has removed the red fluorescence, thus making the chalky blue areas far easier to see **(9)**.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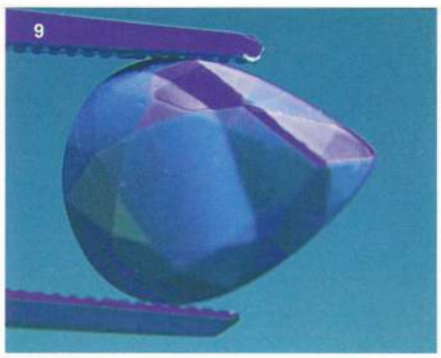
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Summing up

With UV fluorescence, we have something all too rare in gemmology today: an inexpensive test that is as sensitive as even bomb-science level analytical equipment.

Now what does this mean for a gem dealer? With a small UV lamp, one can quickly check potential purchases. Any stones that show a chalky SW fluorescence are most likely heat treated. And for the laboratory gemmologist? This technique has been under-appreciated in the gemmological community. Fluorescence might provide an avenue to determine if some sapphires have received heat treatment at temperatures lower than those normally used for geuda. But this will require adopting some of the techniques and instrumentation of the laser junkie. While expenditures for such instrumentation are hard to justify without a guarantee of just what may be learned, the increasing need to stay abreast of gemstone treatments requires an expansion of our array of techniques. Sophisticated fluorescence instrumentation is far less expensive than such equipment as SIMS or LA-ICP-MS. It is something that gemmologists should seriously consider.

Acknowledgement

The Editors are grateful to Richard Hughes and John Emmett for allowing publication of this article which first appeared on their website at www.ruby-sapphire.com/heat_seeker_uv_fluorescence.htm. RWH wishes to thank John I. Koivula for his encouragement and suggestions during the writing of this article.

All photographs courtesy of Richard Hughes and the AGTA GTC.

Further reading

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For further information on this technique and on photographing fluorescence visit www.ruby-sapphire.com/ heat_seeker_uv_fluorescence.htm ❑

Fake rough

IAN MERCER describes some of the rough 'gem' materials often assembled to be sold, used as credit or for payment

Frequently, rough emerald and ruby are simulated by using quartz, resin filler or glue plus a dye, and coated with rock or mineral fragments in filler resin or glue.

Assembled simulants of emerald rough are often produced with a natural-looking partial coating of black mica flakes and other natural rock matrix materials. A well-made example from South America was once taken into the Geological Museum for identification after customs officers had seized it – complete with its contents of drugs concealed within its hollow core: a 'use of gem materials' we have not noted within our Gem-A Gemmology course notes.

Fake rough 'ruby' specimen and (above) back-lit to show the transparency.

Another favourite, particularly from North Africa, is an 'amethyst geode' which is a natural desert quartz geode with a coating of old-style blue ink over the quartz crystals. The ink dries with an amethyst-like bloom which has a rather iridescent quality and should not baffle those familiar with typical Brazilian amethyst geodes. Anyhow, the ink comes off, which is a bit of a clue. Other geodes from North Africa are made with glued-on coatings of crushed galena, which sparkles invitingly to sun-drenched tourists ready to spend money in the souk.

The rough 'ruby' specimens illustrated have been produced by making dye-covered cores of colourless quartz and giving them a partial coating of quartz, mica-schist and other particles in a bituminous-looking matrix. This may look vaguely natural to those unfamiliar with rough gems in matrix. These specimens were used to make a payment 'in the absence of cash' in Nigeria.

Very large, low-quality rough corundum crystals, occasionally with enhancements in colour, have been offered for many years, particularly from Russia, as collateral for vast bank loans, assuming a lab can be 'persuaded' to produce the required certificate of identity and quality. These specimens are very rarely worth a great deal, and certainly nothing like the millions suggested – more like a few tens to hundreds of dollars.

If anyone has a fake rough 'gem' specimen or a collection of them, we would be interested to hear from them or receive pictures, with a note of the circumstances of acquisition – even (or particularly) if that has some embarrassment factor attached. ❑

The things that turn up

GRENVILLE MILLINGTON describes steps taken to identify a loose green stone

GRENVILLE MILLINGTON is an independent gemmologist who has provided a gem testing service in the Birmingham Jewellery Quarter for many years.

The subject of this article is a transparent stone of 4.60 ct, measuring 10.5 x 9.2 mm and 5.5 mm deep, well-polished and of pleasant, leaf green **(1)**. Even while the stone is still in its plastic bag, one's first impression is always of colour and, like it or not, the mind immediately comes up with a match from previous stones examined (or owned). In this case my mind conjured up a bright, leaf green stone in my collection that is a moldavite (not the usual, dull bottle green, but a bright attractive colour, that was identified as

Green test stone of 4.60 ct.

moldavite by the London Chamber of Commerce Gem Laboratory [the Gem-A Lab in its former guise] in 1954 – no, I'm not that old, I bought it from a now departed stone dealer).

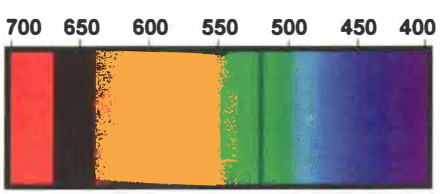
Once the stone was let out of the bag, it was quite obviously not moldavite (or ordinary glass), as it had quite a high lustre — suggesting sapphire

Throughout the stone are planes of extremely thin, roughly circular discs, seen here almost full-on.

or chrysoberyl. The lustre was not approaching adamantine, as you would see in coloured cubic zirconia, sphene or zircon. Also, the dispersion was barely noticeable.

So much for the outside. Under a 10x loupe, there were small transparent discs arranged in parallel planes **(2)** throughout most of the stone and two well defined twinning planes, as you would see in some sapphires or rubies. Enough to decide that the gem was natural, but not enough for a positive identification.

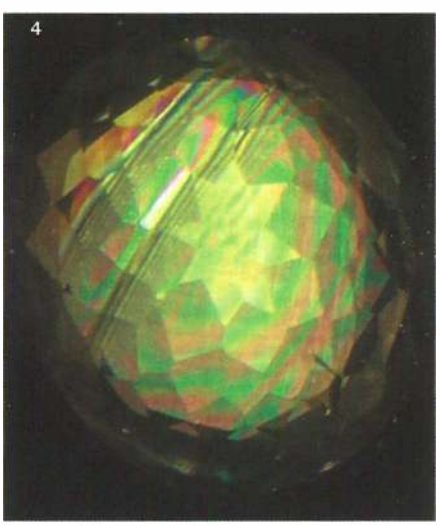
I elected to try the spectroscope next, hoping for a thick band in the blue to violet. Not having found any band, my eye obviously worked towards the left part of the spectrum and found a narrow, fairly distinct band or line in the middle of the green and then, surprisingly, a fairly broad black band in the red/orange **(3)**. This broader band nicely separated the



3 *Absorption spectrum showed two distinct bands. One covering 640 to 670 nm, the other at 520 nm*

red and orange parts of the spectrum and was very similar to the band seen in stained green pieces, such as jadeite. But, this faceted stone was obviously not stained and the spectrum was unfamiliar to me. So, something of a puzzle.

The refractometer next. A negative reading — meaning RI of 1.79 or higher. The surface lustre, as already indicated, did not suggest that the refractive index of this gem was going to be over 1.80.



The stone under crossed polars, showing interference colours and the two twin planes.

Using an old brass microscope with a vernier scale attached to the side (kept for this purpose), I measured the apparent depth of the stone from table to culet, and then by measuring the actual depth with a Leveridge gauge was able to carry out a real/apparent depth calculation. This figure was 1.826 (close to YAG, but I had already decided that this was a natural gem). Viewed under the microscope (the stereo-zoom version, this time) no doubling could be seen, which meant the next step was the polariscope.

The view under the polariscope was most interesting. A strong series of spectral colours with the two twin planes causing

chromatic disruption **(4)**. Turning the stone showed a dark extinction, but it wasn't convincing as a definite double refraction effect (many almandine garnets show this strong extinction on being turned under the polariscope). An attempt at trying to resolve an interference figure was unsuccessful. This meant that I did not know yet whether the stone was singly or doubly refractive. The dichroscope proved equally unhelpful.

Through the Chelsea filter the appearance was yellowish-brown and there was no fluorescence under either long- or short-wave UV. There only remained specific gravity. A careful hydrostatic weighing produced a figure of 4.035, using boiled and cooled water with a small drop of washing-up liquid. Allowing for room temperature will get rid of the final '5', giving an SG of 4.03.

A recap at this stage gives:
- natural gem
- either singly or doubly refractive
- RI = 1.82/1.83
- SG = 4.03
- distinct spectrum, but not yet identified.

Checking a gem list for possibilities produced a strange assortment, as there are not many gem minerals with RIs more than 1.80. Three examples are: hancockite (which is the wrong colour), gahnite and zircon (low-type). The low-type zircons I've examined have all been somewhat misty, with what some dealers call a 'sleepy' look, and/or with prominent zoning being a main feature. This stone was bright and transparent, not sleepy, but with careful alignment under the microscope it had shown some zoning. The low-type zircons generally show a strong, fuzzy band close to where the broad band of this stone is situated, and can show a few other zircon lines or none at all. The spectrum of our test stone **(3)** has the main band in the red/orange part of the spectrum covering 640-670 nm and the fainter but definite line in the middle of the green at 520 nm (measured using a prism spectroscope with wavelength scale). Although zircon can have a couple of dozen lines, it doesn't usually show one at 520 nm.

However, the faint zoning, the RI and SG seemed to match best that of low-type zircon; the transparency could be just an exception to a general rule. Very low-type zircon can have had the crystal structure almost completely destroyed, producing a near-amorphous state with no double refraction. That would explain the non-doubling in the microscope and the strange appearance through the polariscope. The spectrum was distinct enough to be diagnostic. All I had to do was find someone who had come across it before (and knew what stone produced it!).

Who else but Robert Webster? In his great book *Gems*, although the spectra drawings are very few in number, I now have a gem name to work on – I can concentrate on zircon. His drawing of the low-type zircon spectrum just gives a narrow band centred on 655 nm (the main zircon line is at 653 nm) and no other.

Eventually I find what I need to know. In the main text of the zircon chapter is the following:
"The absorption spectrum of the metamict zircons shows a woolly band at the persistent line wavelength of 6535Å [653 nm]. There are some rare variations of the low-type absorption spectrum, one of which ... curiously has been found only in zircons which have a refractive index of 1.82 and a density of 3.98, shows a vague band at 6550Å [655 nm] and another at 5200Å [520 nm]."

So, not only a description of the two spectrum bands but also a match with the refractive index (spot on) and the specific gravity (close enough to accept 3.98 compared to our 4.03). The only difference in the spectrum was that in our test stone the band in the red was very pronounced, rather than 'vague' as mentioned in Webster's description.

Conclusion

A transparent gem of pleasing green colour gave an unusual series of test results, with RI, SG and polariscope suggesting possibly low-type zircon.

This stone did not show the very apparent, easily seen angular zoning usually associated with such zircons, but some straight zoning was seen under the microscope in one direction only. Neither did the stone exhibit the 'sleepy' or hazy appearance of other low-type zircons. The cause for concern was the absorption spectrum, which was distinct enough to be diagnostic, but did not fit in with the usual zircon spectrum.

Robert Webster rode to the rescue in his description of a rare type of metamict zircon which fitted the test results including spectrum.

Sensible observation, carefully obtained RI and SG, accurate details of a distinct spectrum, and persistence in using available texts and information, resulted in a positive gem identification. This is what first interested me in gemmology all those years ago: and it still works! ❑

Dudley Pearl

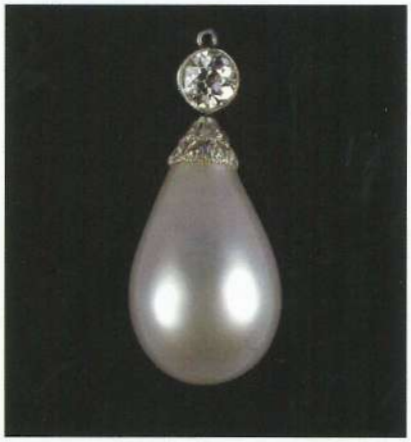


Photo courtesy of S J Phillips Ltd.

The Gem-A Laboratory has been famous for pearl testing since it was set up in 1925 and we have had many a famous pearl through our doors. Most recently we provided a report on the Dudley Pearl (pictured above), one of a fine collection of pearls sold by Lady Dudley at Christie's, London, on 4 July 1902. Kunz and Stevenson (*The Book of the Pearl*, 1908) described the piece as: "A single pear-shaped pearl of the finest orient mounted with a diamond cap, as a pendant, and weighing 209 grains."

Tucson 2006

All the fun of the Fair – the Gem-A team at AGTA Show

For Gem-A, business was busier than ever in Tucson this year, with its task force of three education staff and CEO Dr Jack Ogden, plus Gem-A tutor Annie Law from Atlanta.

Claire Scragg and Doug Garrod at the Gem-A booth.

Tutors, examiners and Teaching Centre personnel from the US and world-wide took the opportunity to meet with Education Director Ian Mercer. Many valuable contacts were made from across the world, to open up new and exciting teaching and field trip opportunities, while membership applications and course enquiries were as strong as ever. Said Ian: "There was considerable interest in the London five-month daytime Gemmology Diploma course which has two start dates each year, as well as the USA-wide home study Gem-A course. Instruments and books, and our special student sets of gems and crystals, drew many to the booth and sales were brisk."

Jenny Soderstrom and Torbjorn Lindwall, who run the Gem-A ATC in Lannavaara, Sweden, compare effects seen through different colour filters at Doug Garrod's tutorial 'Filter Tips'.

Doug Garrod gave his popular practical AGTA-listed tutorial on the use of colour filters. Entitled 'Filter Tips', Doug demonstrated useful and varied results using the Chelsea colour filter and Hanneman-Hodgkinson filters on similarly-coloured stones, providing instantly usable experience for a good roomful of buyers, educators and collectors. Later, Jack Ogden gave a fascinating demonstration on gem lore and expectations in the advertising and promotion of gems.

Days of searching

With some 26,000 dealers and about 30 different shows (we did not go around and count!) running over a three-week period, what better opportunity could we have of purchasing stones for educational use; we also received some very welcome donations to help our students.

The Gem-A team also gathered information on many new stones and sources, treatments, synthetics, and simulants and composites, as well as pricing (which seemed to be generally high this year). For the unusual, and for those who have run out of house room for their stones and specimens, one enterprising stone carver has produced carvings which will hang from your ceiling, using a combination of magnets and metal screws! With space at a premium in London, this gave us an idea...

Claire at the Gravier & Gemmes booth with Gem-A examiner Denis Gravier (centre).

"My first time"

Claire Scragg, a Gem-A education assistant, was overwhelmed by this, her first visit to Tucson. Said Claire: "Nothing can prepare you for the sheer scale of the Tucson shows, it was truly mind-blowing. You are faced with such extremes of choice in both variety and quality; you really do have to be quite focused if you are looking for anything in particular. It was a great opportunity to examine the many varieties of cut and crystal specimens available at the show, from high-quality museum pieces to heaps of rough, from the common to the rare. I was able to talk not only with dealers but also mine owners, who were all more than happy to answer my many questions. I was particularly interested in the different trade names that are being applied to stones, for example 'mint garnet' for very light green grossular garnet.

"It was truly a great learning experience, one that I would recommend to anyone interested in gems – Tucson is a definite 'must see' at least once in your life. My advice would be to plan ahead, visit the show's website and get a feel for what each show has to offer. The various shows each cover one to three weeks and there is not nearly enough time to see it all."

Three of the latest glass-filled rubies (shown against their X-rays taken at the Gem-A lab) purchased at Tucson for student use.

Book signing

Gem-A was proud to host a book signing, with champagne and chocolates, by Maggie Campbell Pedersen FGA, a specialist in organic gems. The event was very well attended, with good sales of Maggie's richly-illustrated book *Gem and Ornamental Materials of Organic Origin*. Held at the Gem-A booth, it enabled people to ask questions of Maggie regarding organics.

Thank you

Our thanks for practical support at the fair go to Eric van Valkenburg of High Pressure Diamond Optics, Dr Annie Law and Maggie Campbell Pedersen.

At a Show near you

Meet the Gem-A team at the Las Vegas JCK Show in June, and International Jewellery London and the Hong Kong Jewellery and Watch Fair in September 2006. ❑

Diamond Number 143

GILLIAN MALLETT reports on an interesting diamond from a collection at the Sedgwick Museum, Cambridge

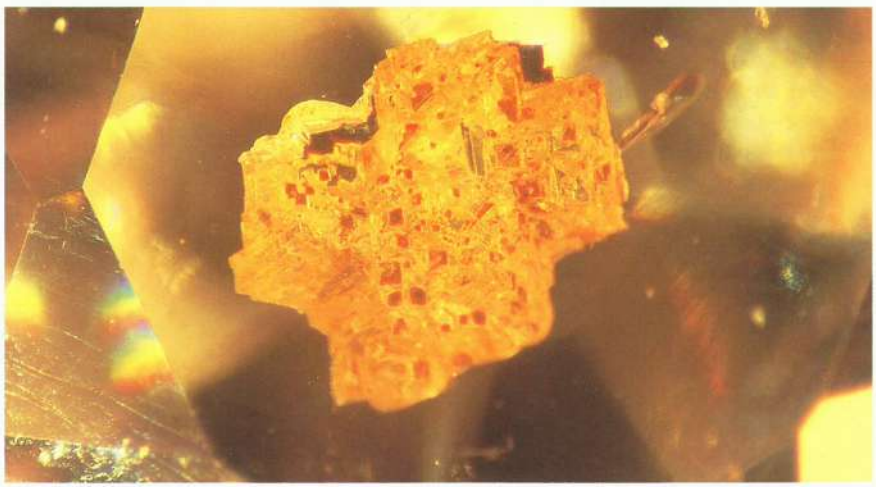
Gem collector Sir Abraham Hume (after whom humite was named) had his collection of diamonds catalogued in 1815 by the Count de Bournon. The diamonds were all crystals except Number 143. Those of known origin came from Brazil and the collection certainly predated the finding of diamonds in Africa. Professor William Miller (of Miller's Indices fame), persuaded Viscount Alford, the heir, to give them to the Mineralogical Museum (now the Sedgwick Museum) of Cambridge University when Hume died in 1839. The diamonds are mostly small, varied in shape with many inclusions and, though of great scientific interest, of little commercial value. They were elegantly mounted on turned ebony pegs in a velvet-lined case of red mahogany.

Jacques Louis, Count de Bournon, came to England to escape the French Revolution which he referred to as, "an event equally unexpected as it has been disastrous and afflicting to humanity having occasioned my return to this happy and hospitable land ...". He argued that the basic building block of the cubic crystal system was the octahedron, disagreeing with the Abbé Hauy who favoured the tetrahedron. The present idea is of a face centred cube as the unit cell (with 14 carbon atoms).

Diamond number 143 is a 0.75 ct faceted stone described in the catalogue as: "A cut transparent diamond of a clear water containing a grain of native gold which appears to be of a regular shape possibly an octahedron. This specimen is extremely rare. Brazil."

I was intrigued by the inclusion in the cut diamond and so took the stone to the Gem-A Gem Testing Laboratory for scrutiny. Under the microscope it could be seen that the inclusion was transparent so clearly it was not gold, but it had the appearance of iron oxide. Unfortunately the high fluorescence of the diamond masked the Raman peaks that could have identified the material.

My grateful thanks to Professor Andy Rankin of Kingston University for his kind assistance. ❑



The 'gold' inclusion in the diamond.

Titanium the rainbow metal

LYNNE BARTLETT gives a résumé of her presentation to the Society of Jewellery Historians in October 2005

Titanium, a lightweight, silver-grey metal, is a familiar part of the modern jewellery designer's repertoire, but today is rarely used for the rainbow colours that made it such a desirable material nearly forty years ago.

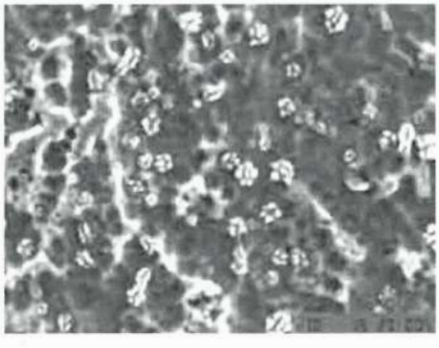
Part of my PhD project at Central Saint Martin's College of Art and Design has been to trace the history of the use of titanium by exploring how the creativity of key jewellers was stimulated by this novel and unusual metal.

For thousands of years jewellers have used metals with the limited colours of yellow, red and white. Other materials and methods were needed to add colours such as blue and green. Titanium, introduced to the jeweller in the 1960s, was the first new metal to become available in the 20th century and it offered the possibility of a strongly coloured metal surface without painting or enamelling.

1

Anodised titanium wire spirals (inset) showing the mid-range of interference colours, subsequently cut to form the links of the tubular chain mail bracelet. Lynne Bartlett, 2005.

Although the existence of the new element was established in the late 18th century, it was not isolated as a pure metal until 1910 and only produced commercially in the 1950s. The late isolation and exploitation of titanium could be taken as an indication that it is a rare element but this is not so. Titanium is relatively abundant at 0.6 % of the earth's crust, and it is also present in the atmosphere of the sun and in interstellar space. It is the ninth most common element and the fourth commonest metal after aluminium, iron and magnesium. However it is very reactive and, unlike gold, silver, copper and iron, it is never found as a pure metal. This very reactivity is why it is so difficult to isolate and process as a pure metal. Even today a batch method is used which makes production relatively slow and expensive. Within minutes of its production, unless it is in an inert atmosphere, a thin, tough, protective oxide layer forms on the surface. This layer, only a few nanometres thick, protects the metal from further attack. The growth and manipulation of this oxide layer creates colour on titanium. The colours produced are due to interference **(1)**, an optical phenomenon which depends solely on the thickness, transparency and refractive index of the oxide layer. The investigation of the thin oxide layers forms the scientific part of my project which is not reported here, but some interesting features which I have called 'flower oxides' in memory of the late Professor Harvey Flower, were observed **(2)**.



2 *Throughout the stone are planes of extremely thin, roughly circular discs, seen here almost full-on.*

The arrival of a new metal in a traditional craft area came at a period of radical change in design and making. Students, influenced by the International Exhibition of Modern Jewellery at Goldsmiths' Hall in

1961, were embarking on courses which encouraged them to experiment with non-traditional materials. The initiative to use titanium came from the metals industry, in the person of J B Cotton, a senior researcher at IMI (a division of ICI), who in 1964 suggested to Gerald Whiles that students at the School of Jewellery in Birmingham might like to experiment with it.

3

Titanium brooches by Ann Marie Shillito, laser cut with integral pins and anodised. 1991.

Ann Marie Shillito, one of the first jewellers to use titanium, made the earliest identifiable piece of designed titanium jewellery in 1967, a belt buckle machined from thick sheet and coloured by anodising. Her experimentation with the metal continued at the Royal College of Art (RCA) and throughout her career. She has used it in casting with silver, for integral earwires and pins, and for forged pieces **(3)**.

The use of titanium spread through the jewellery school network in the late 1960s as pieces incorporating the new metal featured in degree shows.

The exhibition at the Electrum Gallery in October 1976, the first to be devoted to the new metal, featured three students from the RCA, Edward de Large, Kevin Coates and James Brent Ward. Edward de Large developed his own painstaking heat and anodising techniques to produce exquisite cloudscape brooches **(4)**, while for Kevin Coates titanium was just one of many materials chosen for visual impact. Brent Ward, with sponsorship from the Goldsmiths' Company, published a report in 1979 that became the standard guide for jewellers on working with refractory metals.

Brian Podschies, a Birmingham student in the mid 1970s, became 'bored with just colour' and used hot-forging as a way to achieve more visually 'organic' surfaces **(5)**.

In the early 1980s Debbie Moxon, inspired by the work of Edward de Large, developed her own method of heat-colouring titanium using precise geometric scoring and a fine flame **(6)**.

Titanium was first used for jewellery in the UK. However, the 1978 LOOT exhibition in Minneapolis featured several titanium pieces and subsequent workshops given in the USA by UK jewellers carried the use of it across the Atlantic.

For the first decade of its use, up to the mid 1970s, titanium was regarded as a special material used to produce one-off or limited edition pieces. The second half of the 1970s and the early 1980s saw production move to a more industrial scale. Companies such as Simbol, Prism and Dust produced simple multi-coloured jewellery for the mass-market and the perception of titanium changed.

Artist craftsmen who found the problems of using titanium too frustrating, both technically and commercially, but liked the colour possibilities, moved on to niobium and tantalum, introduced to jewellers in the UK by Peter Gainsbury, Technical Director with the Goldsmiths' Company.

The light weight of titanium, so important in industry, was seen as a disadvantage in a jewellery market where value is associated with weight. It has been used successfully in maces: in 1972 for the Open University (designed by Eric Clements and made by Hamish Bowie) and in 1988 for Birmingham Polytechnic (designed and made by Terry Hunt).

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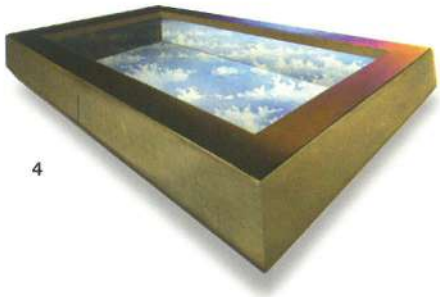
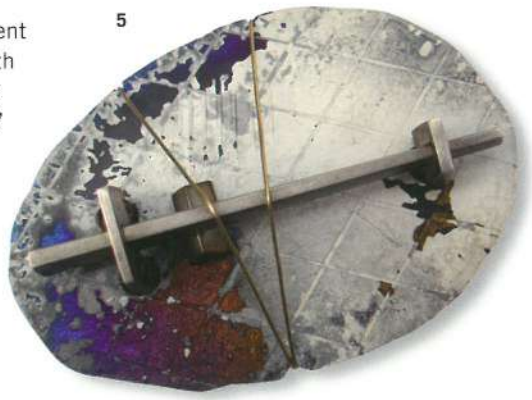


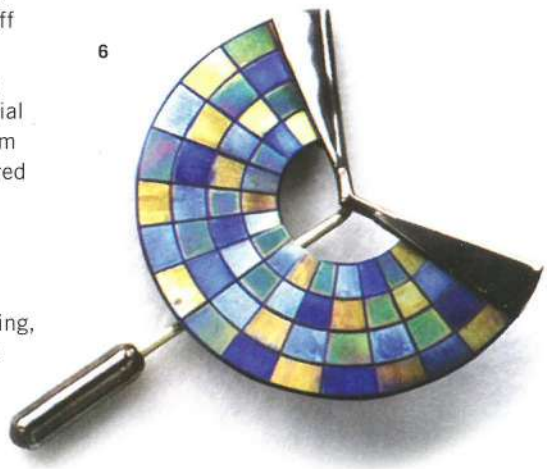
Titanium brooch with silver frame by Edward de Large. Photo courtesy of Ann Allnutt.

5



Hot forged and anodised titanium brooch with silver and gold by Brian Podschies c. 1985.

6



Heat-coloured titanium brooch with silver mount by Debbie Moxon, 1982.

In recent years the strength and lightness of pale grey, uncoloured titanium have featured in sports equipment, spectacles and jewellery (particularly for men) and the iconic Apple-Mac Titanium Power Book.

There are however a few early signs of a renewed interest in the colouring of titanium both from designer/makers such as Joel Degen and commercial companies.

Research has come full circle at Birmingham forty years after its first introduction there, where Ann-Marie Carey is working at the Innovation Centre on laser marking of titanium. ❑

Patent Round-up

Some diamond-related patents from 2005

The development of ever-improving high pressure, high temperature (HPHT) treatments for diamonds is reflected in the number of relevant patents from 2005.

US2005260935 (no applicant name on the Patent, but names of inventors point to GEC/Lazare Kaplan) is for "treating discolored natural diamond, especially Type IIa diamond and Type Ia diamond with nitrogen as predominantly B centers, for improving its color." The process described includes "preblocking and preshaping a discolored natural diamond to prevent its breakage" during the HPHT treatment.

Also from GEC/Lazare Kaplan (US2005249655) is a Patent for a process "to make colorless diamonds from discolored Type IIa diamonds", "to make blue diamonds from discolored Type IIb diamonds" and "to make colorless diamonds from discolored Type IaB diamonds". Both this and the last, as will be noted, include treatment for Type IaB diamonds.

From Korea Atomic Energy Research comes a Patent for a method to produce coloured diamond by ion implantation and heat treatment (US2005196547). Here the surface of the diamond is implanted by ions by "accelerating the ions under vacuum" and then the diamond is heat treated. The process provides a "colored diamond having a uniform color ...by a simple process at low cost". All types of ions may be used but "an ion selected from the group including Be, B, N, O, Mg, Al, P, S, In, Sb, Te, Ti and Bi is preferably used and, more preferably, N or B is used."

Identity marks

The increasing variety of treated and synthetic diamonds means that methods to identify them and detect them are vital and patentable. Ways of marking diamonds include one by Gersan (WO02066262, published in August 2005) that describes how names or logos may be applied to the surface of diamonds by such processes as a microlithographic process using plasma and gold resists, followed by UV laser ablation and plasma etching or "the direct effect of intense pulsed ultraviolet light". These two processes themselves are not new, but the Patent describes a new technique by which the mark can be varied "so as to produce, say, sequential numbering". Coming from Gersan (the Lichtenstein-based research establishment of De Beers) it is interesting to note that the Patent describes how the presence of such marks – including the De Beers' mark – maybe "detectable, with experience under 10x magnification" and how this has prompted discussion in the diamond grading world. The Patent observes that "as the marking of diamonds becomes more popular, some visibility of the mark may be acceptable."

Coloured gems and pearls

Methods of providing identification are not limited to diamonds. In recent years, all manner of inscriptions – coded dots, imprints and the like – have been proposed to tag and identify gems. Advances in micro electronics has also resulted in several patents which electronically tag gems by mounting miniature integrated circuits on their surfaces (such as Patent WO2005027677) or even on the nucleus of a cultured pearl "before the nucleus is inserted into the pearl oyster" (WO2005015986). However, bearing in mind the advances in such things as plasma etching of diamond surfaces and ion implantation, will it be long before minute electronic tagging can be incorporated into a diamond surface?

CVD diamonds

From Element Six (De Beers Industrial Division research arm) comes a way to identify a diamond grown by the chemical vapour deposition (CVD) process (WO2005061400). Here a dopant is introduced into the source gas "to produce the mark of origin or fingerprint in the synthetic diamond material". The Patent explains that the dopant is selected so that the "mark of origin or fingerprint is not readily detectable or does not affect the perceived quality of the diamond material under normal viewing conditions, but which mark of origin or fingerprint is detectable or rendered detectable under specialised conditions, such as when exposed to light or radiation of a specified wavelength, for example."

Methods of detection

One detection process from Gersan, entitled simply 'Examining a diamond', provides a method to determine whether a blue-to-green diamond has been artificially irradiated or ion bombarded to change its colour or if it is a natural/synthetic doublet (WO03023382). The diamond is irradiated with light at specific wavelengths and the stimulated emission of luminescence as seen at various depths into the stone is measured by using a spectrometer and a confocal microscope as the focal plane is scanned vertically through the diamond. The change in luminescence with depth will vary depending on whether the stone exhibits natural irradiation, ion bombardment or is a natural/synthetic doublet.

Diamond grading

Following the recent introduction of diamond cut grading by the GIA and the AGS grading laboratories, we are waiting to see what other aspects of diamond grading are about to be automated and/or quantified. The accurate and consistent colour grading of diamonds by machine has been sought for some time. Technology is improving here and new techniques introduced, such as Belgian Patent BE1015734 (publication date:

UK Auctions – Spring 2006

BONHAMS www.bonhams.com

New Bond Street (t: 0113 244 8011)
Fine jewellery: 6 April

Bath (t: 01225 788 988)
County Sale inc: silver and jewellery: 24 April, 22 May

Edinburgh (t: 0131 225 2266)
Jewellery and silver: 8 June

Oxford (t: 01865 73252)
Jewellery: 9 May, 13 June

CHRISTIE'S www.christies.com

South Kensington, London (t: 020 7930 6074)
Fine jewellery: 4 April, 27 June
Jewellery, unredeemed pawnbrokers' pledges: 9 June
Jewellery: 3 May, 1 June

King Street, London (t: 020 7839 9060)
Jewellery: 14 June

DREWEATT NEATE www.dnfa.com

Donnington, Newbury, Berkshire (t: 01635 553553)
Affordable jewellery and silver: 23 May

Godalming (t: 01483 423567)
Jewellery, silver and objects of vertu: 5 April, 28 June
Jewellery and silver: 9 May

Apsley Road, Bristol (t: 0117 973 7201)
Antiques, jewellery and silver: 25 April

Neales, Nottingham (t: 0115 962 4141)
Jewellery, silver, ceramics and glass: 27 April

FELLOWS & SONS www.fellows.co.uk

Birmingham (t: 0121 212 2131)
Second-hand jewellery and watches (by direction of Pawnbrokers Nationwide): 6 and 27 April, 11 and 25 May, 8 and 22 June
Antique and modern jewellery: 20 April

GARDINER HOULGATE www.gardinerhoulgate.co.uk

The Bath Auction Rooms, Bath (t: 01225 812912)
Jewellery: 14 June

LYON AND TURNBULL www.lyonandturnbull.com

33 Broughton Place, Edinburgh (t: 0131 557 8844
Jewellery and silver: 27 April

SOTHEBY'S www.sothebys.com

New Bond Street (t: 020 7293 5000)
Jewels: 29 June

WOOLLEY AND WALLIS www.woolleyandwallis.co.uk

Salisbury, Wiltshire (t: 01722 424500)
Jewellery: 26 April

Dates correct at time of going to press but may be subject to alteration.

July 2005) by 3D Diamonds for a method to assign "a color to the diamond on the basis of the amount of light absorbed by it".

Particularly noteworthy here is a recent Patent from the GIA for measuring the ultraviolet fluorescence of diamonds (WO2005067566). In simple terms the device consists of an emission chamber, an upper and lower UV emitting diode to provide both "trans-radiation and direct radiation" to the gemstone, and a light detector. The UV sources can be varied in intensity to calibrate the device and the measured visible light output "can then be converted into a fluorescence grade for the gemstone under test."

More ambitious is a Patent from Image Statistics Inc (US US6980283) for equipment which will "extract consistently and accurately, size, shape and proportion information" which may be used to provide "cut analysis, weight calculation, and for assigning a cut grade". The invention will also "measure color and assign a color grade to a gemstone" and "identify, delineate, and measure flaws and assign a clarity grade to a gemstone". That's not all. "Another object of the invention is to check for fluorescence, its intensity as well as the characteristics of the radiation emitted as a result of ultra violet stimulation." Yet a further object of the invention is "to measure brilliance and scintillation of a gemstone" and "measure reflectance from the table of the gemstone, identify surface scratches and describe the shape and size of the table." Then, "A further objective of the invention is to authenticate a gemstone." This is done in various ways based on the data obtained and by such methods as placing Chelsea, polarising and other filters in the light path.

Quality of cut

Of the various ways for a customer to visualise the quality of cut in a diamond, the Beauty Scan used in the De Beers' stores is probably the most aesthetically pleasing – so much so that the amazing light patterns it generates are projected out of the De Beers Rodeo Drive shop in Beverly Hills onto the pavement at night. Is this equipment one and the same as the "Apparatus for generating data for determining a property of a gemstone and methods and computer programs for determining a property of a gemstone" (US2005036132 and BE1013762, the latter from Overseas Diamonds, NV, Belgium)? In this Patent the diamond is placed so that "the axis of symmetry is parallel to an axis X passing through the observation position; an illuminator arranged to illuminate a gemstone so placed with a spatially varied light pattern; a rotator arranged to cause relative rotation between the light pattern and the support structure generally about the axis X; and a camera arranged to capture, at each of a plurality of rotational positions, an image of light returned by the gemstone." ❑

J.O.

Stone Scoop

A gemiscellany

Hot Rocks

The current spotlight on high pressure high temperature (HPHT) diamond treatments is a reminder that attempts to improve the appearance of diamond by heating are nothing new. In describing the diamond mines at Rasmmalakota in India, 17th-century French traveller Tavernier says how "the merchant prefers a black point [i.e. inclusion] in a stone to a red one. When there is a red one the stone is roasted, and the point becomes black."

It is said that when Robert Boyle's experiments in the total combustion of diamond were attempted in Paris in 1771, the jeweller Le Blanc announced that such combustion was impossible and that he had frequently heated diamonds to remove defects. To prove this, he placed a diamond in a crucible with a mixture of lime and charcoal dust and subjected it to a fierce heat. Le Blanc was proved wrong and Boyle right – the diamond disappeared.

They tried to improve diamond colour as well as clarity. The UK trade magazine The Jeweller and Metalworker for 15 July 1875 noted that off-coloured diamonds could be made colourless by strong heating and that in most cases this was permanent. They also described how one diamond merchant "exposed a diamond to a very high temperature, in order to destroy its brownish colour, but the stone became of a permanent rose red."

Just three years later, in 1878, a Patent was granted to Charles Riballier of Paris for "An improved process of Decolouring Coloured Diamonds". Riballier was more sceptical of the older processes which had "generally consisted in putting the diamond in an ordinary crucible with strong chemical agents and heating them together to a high temperature." This, he explains, had never produced the desired decoloration, but had attacked the diamond surface. His improved method consisted of placing the diamonds and the 'chemical' agents, in a sealed crucible in a gas or charcoal-fired furnace. The sealed crucible protected the diamond from the air and Riballier quite unequivocally said: "I can obtain from coloured diamonds white brilliants, the surface of which is in no way altered, and of which the brilliancy of the facets have lost nothing in the operation.'"

A rock and a hard place

An investigation by researchers at University College London, Moorfields Eye Hospital and Archway Sexual Health Clinic (*Current Biology*, 24 January 2006, 16(2)) has found that Viagra can affect vision. Previously it had been noted that at high doses of Viagra men had reported seeing a blue haze, but the recent research shows that even at the standard dose level, the drug affected ability to pick out changes of image against a blue background. The researchers stress that any effect from normal doses of Viagra are mild, but should diamond grading laboratories take note?

The lore and the profits

As part of a presentation on the value of 'gem lore' and history in raising customers' interest in gemstones given at Tucson this year, the editor of this column collected some examples of medieval 'gem lore' that either had basis in fact or were easy to explain. For example, some medieval lapidaries say peridot counteracted lunacy. When the highly influential early medieval lapidary was written in Latin by Bishop Marbode in the 11th century, he described the peridot as 'touched by the moon'. The moon is *lunam* in Latin, so presumably Marbode had simply miscopied the Roman writer Pliny's accurate statement that peridot, being soft, is 'touched by the file'. The latin for file is *limam*.

A 15th century French texts says that a gem engraved with a camel with long flowing hair will bring peace between man and wife. How might that have originated? Well, the French text specifies a dromedary, the original ancient Latin text the goddess Andromeda.

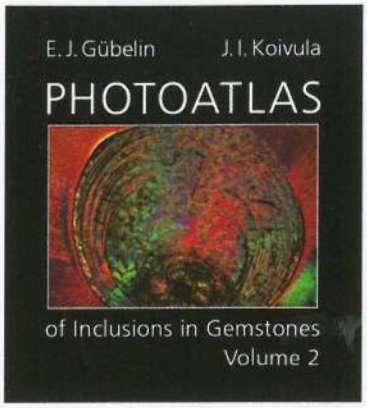
LED astray

During a recent Gem-A Gem Discovery Club evening it was noted that gems that appeared red through a Chelsea Filter using 'normal' lights, including a desk light or a 'pen-light', such as an emerald and a cobalt-treated stone, didn't show this effect when a white LED light source was used. The narrow output range of a typical white LED (with a major peak in the blue) explains this, but as LED light sources are increasingly being used, readers are warned to remember this – and the similar consequences can be expected when using a LED light source with a spectroscope.

That said, the cheapness, large range and specific wavelengths of LEDs are making them increasingly useful in gemmology – blue LEDs for example can make a perfect replacement for the old copper sulphate solution. ❑

J.O.

New titles from Gem-A



Photoatlas of Inclusions in Gemstones

The long-awaited 2nd volume of this monumental work now released

By E J Gübelin and J I Koivula. 820 pp, over 1700 colour plates. Opinio, Basel. ISBN 3-03999-029-2. £160.00 plus postage and packing.

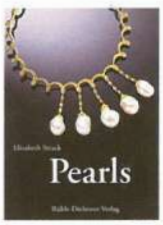
The second volume of the series which began with the *Photoatlas*, continues the name, differentiating the text by announcing it as Volume 2. The contents include, after a general description of inclusions, a more detailed account of their characteristics. Readers will be eager to know which species are dealt with and which are still to be covered. In this volume are inclusions in gems of commercial importance; amber, beryl, chalcedony, chrysoberyl, feldspar, garnet, opal, quartz, spinel, topaz, tourmaline, zircon and zoisite. The final (3rd) volume will deal with inclusions in diamond, corundum and other major gem species.

While a full review of the book will appear in the April issue of *The Journal of Gemmology*, readers may be interested in the history of Professor Gübelin's monographic inclusion studies. In 1953 Gübelin's *Inclusions as a Means of Gemstone Identification* was published by the Gemological Institute of America. Most of the photographs were in black-and-white and the 223-page book is not easy to find now.

In 1973 *Innenwelt der Edelsteine* was published by ABC Verlag of Zürich and a translation, *Internal World of Gemstones*, followed from the same publishers in the same year with the same ISBN 3 85504 030 3.

In 1986 Gübelin began his collaboration with John I Koivula, then a member of the GIA staff. *Photoatlas of Inclusions in Gemstones*, ISBN 3 85504 095 9 is now the first volume of what is intended to be a three-volume work.

Michael O'Donoghue

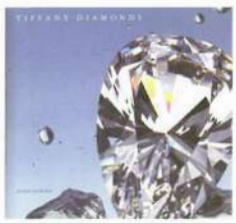


Pearls

by Elisabeth Strack, 2006. 707 pp, 660 mostly coloured illustrations. Rühle-Diebener-Verlag, Stuttgart. Hardcover and dust cover. £75.00 plus postage and packing.

This English translation of *Perlen* published in Germany in 2001, is a revised and updated version of the original book. It describes new developments that have occurred in the pearl trade over the past four years. This is the ultimate book on pearls, a thoroughly researched reference book and a 'must have' for anyone with an interest in pearls.

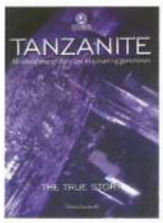
A full review of the book will be published in the April issue of *The Journal of Gemmology*.



Tiffany Diamonds

by John Loring, 2005. 303 pp, 250 colour illustrations. Harry N. Abrams, Inc., New York. Hardcover ISBN 0-8109-5937-2. £25.95 plus postage and packing

Handsomely produced and beautifully illustrated with archival photographs, sketches, drawings, and new photography of antique and contemporary jewellery, this book celebrates Tiffany through its history and jewellery. Author John Loring, design director of Tiffany & Co. since 1979, recounts intriguing tales of many of the world's famous diamonds. His anecdotes about the illustrious owners of Tiffany diamonds provide a glimpse into their glamorous lives.



Tanzanite

by Valerio Zancanella, 2004. 118 pp. Raffaele Zancanella, srl, Cavalese, Italy. Paperback ISBN 88-901509-0-4. £20.00 plus postage and packing.

Subtitled 'All you need to know about this fascinating gemstone', this well-illustrated book contains information on the geology of the stone, how it is mined, gemmological data, heat treatment, and imitations and how to detect them. In addition, Zancanella tells the story of how this new variety of zoisite was discovered. His interview with Jumanne Ngoma, who has a certificate from the government of Tanzania acknowledging that it was he who discovered tanzanite, makes for very interesting reading.

John Goodall

It is with great sadness that we report the death of John Goodall FSA on 23 November 2005. John was one of the founders of the SJH.

Jack Ogden recounts: "Way back in late 1976 or early 1977 I had been pondering over the wide range of disciplines and professions connected with jewellery history – from collectors to dealers to curators to scientists – and was thinking that some sort of society or club and news sheet to link them might serve a useful and interesting purpose. I mentioned this idea to John, a frequent visitor to the gallery I then had in St James's. He was a fund of information on all sorts of helpful, though often wildly esoteric, things to do with ornament and history. Over the following weeks we discussed various approaches and our enthusiasm grew. John then played his masterstroke. He offered to use his close connections with the Society of Antiquaries and some of its fellows to see if some sort of steering committee might be set up. The rest, as they say, is history — Jewellery History. The Society of Jewellery Historians was officially launched at its first meeting, at the Society of Antiquaries, on 21 November 1977 when its first President, Reynold Higgins (Keeper of Greek and Roman Antiquities, British Museum) lectured on 'Roman Jewellery'. The following two lectures, in February and May 1978, were 'Tudor and Stuart Jewellery' delivered by Roy Strong (then Director of the Victoria and Albert Museum) and 'Amulets and Auspicious Symbols in Asian Jewellery' by John Goodall. The first Committee comprised: The President, Honorary Secretary – Shirley Bury (Deputy Keeper of the Department of Metalwork, V & A), Nigel Israel as Honorary Treasurer, Jack Ogden, Hugh Tait (Deputy Keeper of Medieval and Later Antiquities, BM), Graham Hughes (Art Director of the Worshipful Company of Goldsmiths), Diana Scarisbrick (Jewellery Historian) and John Goodall as Newsletter Editor. Without John's diligently produced Newsletters much of the Society's history would have been lost (indeed the above lecture and Committee details have been extracted from the first issue), and they remain, along with the Society itself, as just some of the many memorials to his work." ❑

SJH Meetings

Unless otherwise stated, all lectures are held at the Society of Antiquaries, Burlington House, London W1, and start at 6:00 p.m. sharp. Lectures are followed by an informal reception with wine. Meetings are open only to SJH members and their guests. A nominal charge is made for wine to comply with our charity status.

Tuesday 25 April
MARY CAHILL
Gold Boxes, Bobbins and Notion: Late Bronze Age Gold from Ireland

Tuesday 23 May
JAMES ROBINSON
Medieval Spring: Romance, Love Tokens and Gift-Giving

Tuesday 27 June
JUDY RUDOE
Queen Charlotte's Jewellery: Re-appraising a Sophisticated Collector

Tuesday 26 September
WALTRAUD GANGULY
Highlights of Indian Ear Ornaments, their Historical and Mythological Background

Tuesday 24 October
DAVID MITCHELL
17th-Century Jewellers' Practice as Revealed Through Bankers' Records

Tuesday 28 November
MARC BASCOU
Title to be announced

Forthcoming SJH Meetings

Tuesday 25 April
MARY CAHILL
Gold Boxes, Bobbins and Notion: Late Bronze Age Gold from Ireland
Mary Cahill MA FSA is Assistant Keeper in the Irish Antiquities Division at the National Museum of Ireland, with responsibility for the prehistoric collections. Primarily interested in prehistoric gold, she has published widely on Bronze Age gold, history of collections and antiquarianism in Ireland.

Tuesday 23 May
JAMES ROBINSON
Medieval Spring: Romance, Love Tokens and Gift-Giving
James Robinson is Curator of the medieval collections in the Department of Prehistory and Europe at the British Museum. He reports on finds of treasure that are declared according to the terms of the Treasure Act and has recently completed a small book on the Lewis chessmen.

Tuesday 27 June
JUDY RUDOE
Queen Charlotte's Jewellery: Reappraising a Sophisticated Collector
Queen Charlotte owned prodigious quantities of jewellery. Much of it was described with awe by her contemporaries. Yet today only a handful of pieces remains in the Royal Collection. This lecture brings together the different elements of her collection in all its astonishing diversity, to establish what it might once have looked like. Much is known of the state jewels and prestigious gifts, and these will be discussed in brief, but the main focus will be on the Queen's personal collection. At her death her four unmarried daughters selected what they wished to keep; the rest was sold at auction. Because of this immediate dispersal, the personal collection has been little appreciated, but in so far as the Queen chose much of it herself, it tells us a great deal about her. Like George III, she had a passion for hard stones in all their variety of colour and natural markings, and a love of cameo jewels, alongside a scholarly interest in glass casts of engraved gems by Tassie. Other jewels convey messages of love and affection, indicating a taste for sentiment characteristic of her age. Even if none of these items survives, illustrations of comparable pieces will be used to place Queen Charlotte's personal collection in a wider context as a remarkable record of what was available in the later 18th and early 19th century, and to shed new light on Queen Charlotte as a keen follower of fashion and as a woman of intellect and sensibility.

The lecture will expand the research carried out for *The Wisdom of George III: papers from a Symposium at the Queen's Gallery, June 2004* (Royal Collection Publications 2005). ❑

Members' meetings

London

Tuesday 16 May
FABERGÉ AND THE RUSSIAN JEWELLERS
A private viewing of the exhibition at Wartski's, London W1 (see p.6)

Tuesday 27 June
SOTHEBY'S, NEW BOND STREET
AGM followed by a Gallery tour and Private Viewing of Sotheby's Antiques Sale.

Midlands Branch

Friday meetings will be held at the Earth Sciences Building, University of Birmingham, Edgbaston. For details call 0121 445 5359.

Friday 31 March
JOHN HARRIS
Chasing rainbows by observing gemstone spectra

Saturday 17 June
SUMMER SUPPER PARTY

North East Branch

For information call Mark Houghton on 01904 639761 or Sara North
email sara_e_north@hotmail.com

Thursday 20 April
DAVID CALLAGHAN
Cameos and intaglios

Thursday 13 July
BRIAN DUNN
The Naughty Nineties

North West Branch

Meetings will be held at YHA Liverpool International, Wapping, Liverpool L1 8EE. For further details contact Deanna Brady on 0151 648 4266.

Wednesday 19 April
MELANIE FRANCIS
The trends of Tucson – 2006

Wednesday 21 June
BRIAN JACKSON
A review of the garnet family

Wednesday 19 July
TRACEY JUKES
Thoughts from 'a broad' – a trip around the world of coloured gemstones

Scottish Branch

For information call Catriona McInnes on 0131 667 2199,
e-mail scotgem@blueyonder.co.uk
website www.scotgem.demon.co.uk

Scottish Branch Conference, Perth
Friday 28 April to Monday 1 May

Speakers will include:
Dr Karl Schmetzer (keynote), Richard Digby, Alan Hodgkinson, Helen Molesworth, Dr Mark Newton and Thom Underwood

- Lectures and presentations
- Workshop sessions
- Demonstrations and displays
- Social programme
- Field trip

South East Branch

For information contact Colin Winter on 01372 360290 **email** info@ga-seb.org
website www.ga-seb.org

South West Branch

Meetings held at the Bath Royal Literary Scientific Institution from 1:00 to 5:00 p.m. For information contact Richard Slater on 01635 553572
email rslater@dnfa.com

Sunday 23 April
STEPHEN KENNEDY
Recent developments in the UK coloured stone trade

Gem Discovery Club Specialist Evening

Once a month Club members have the opportunity to examine items from the collections of gem and mineral specialists. Short introductory talks are followed by hands-on sessions under the guidance of the guest specialist.

Tuesday 4 April
JASON WILLIAMS
Synthetic gem production in Southern China

One-day workshops

An Introduction to Gemmology
Monday 3 April
A day of practical hands-on observation, the course will introduce you to many varieties of cut stones and crystals and gem testing equipment.
Gem-A Members £125.00
(Non-Members £138.00)

Bead-Stringing Workshop
Wednesday 5 April
Learn the techniques needed for successful stringing. All materials provided.
Gem-A Members £149.00
(Non-Members £160.00)

The Light Fantastic
Monday 8 May
A workshop totally dedicated to light and colour – why we see colour, how light reacts with materials. This is very much a hands-on practical day.
Gem-A Members £125.00
(Non-Members £138.00)

Valuing Antique Jewellery
Tuesday 9 May
Led by valuation specialist Brian Dunn, this workshop will cover the identification of styles, methods of manufacture and dating of antique jewellery.
Gem-A Members £149.00
(Non-Members £160.00)

Rough Diamond Course
Friday 14 July
Gain a basic understanding of rough diamonds and the diamond pipeline, as well as a practical grounding in the handling and recognition of diamond qualities, shapes and colours. Run in conjunction with Dennis Terry of Dianet Ltd.
Gem-A Members £225.00
(Non-Members £242.00)

All workshops held at Gem-A London headquarters.
Visit www.gem-a.info for the latest information on all Gem-A workshops or call Claire on 020 7404 3334

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