

Gems & Jewellery

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Gem-A Conference 2009

Brief reports on the lectures presented at the Gem-A Annual Conference held at the Hilton London Kensington on Sunday 18 October 2009.

Filter tips

After a brief welcome, the first speaker was the well known author and gemmologist **Antoinette Matlins**, who described the uses of Gem-A's Chelsea Colour Filter (CCF) (1). The CCF — developed at Chelsea Polytechnic, London, where Gem-A courses were taught in the early days — was celebrating its 75th anniversary in 2009. Antoinette demonstrated with panache how the CCF, along with a small bag of other basic gemmological equipment (loupe, calcite dichroscope and Maglites), could be used to identify some 85% of the stones commonly encountered on the market. Add a UV light and the percentage rose to around 90%.

With the CCF there were a variety of simple guidelines. One of the most useful applications Antoinette demonstrated was using the CCF to scan quickly parcels of any coloured gemstone; with virtually no experience, one can spot less expensive look-alikes or fakes that are mixed in because their reaction — whatever it is — will be distinctly different. This was demonstrated with a row of 'paraíba-coloured' stones that were very close in colour, in which two were Paraiba tourmaline, one was a YAG and one apatite. The delegates had no difficulty immediately seeing differences in the three materials, quickly and easily.

The value of the CCF becomes even greater with experience, and knowing how a particular gemstone is supposed to react. If a supposed aquamarine, for example, showed red through the CCF it would not be aquamarine. Indeed, with most blue gems red equals fake. Exceptions included natural cobalt spinels and most tanzanite. With green stones, however, the gemmologist might hope to see red; tsavorite garnets, chrome tourmalines and many emeralds showed red. With the red stones, ruby, of course, showed red, with synthetic ruby showing 'super red'.

With experience, the CCF can also alert the gemmologist to the possibility of colour treatment and even doublets.

Antoinette reminded participants that it was also essential to stay up to date through publications, the web and such forums as Gem-A's MailTalk, and that through ignorance as much as malice, suppliers' descriptions could not always be trusted. She also pointed out that it was wrong to talk about stones being 'inert' under the CCF because all stones have a reaction, even though it may not be 'red'; developing an eye for subtle differences in shades of red or green is also valuable. During the lunch break Antoinette signed copies of her book *Jewelry and Gems: The Buying Guide*.

Flash Photography

To the novice gemmologist, gemstone spectra can be hard to see at first using a small, hand-held spectroscope. Even experts have considerable difficulty photographing what they see. **John Harris**, a Gem-A tutor since 1986, is a true maestro in the art of photographing spectra — indeed his photos are used in the new Gem-A Gemmology Foundation and Diploma course notes.

After introducing the background, from Newton to Anderson and Payne's research, John talked about his passion and experiences in 'Chasing Rainbows', his work with the gemmological spectroscope. He explained that so-called reflected light really meant internally reflected light and he recommended diffused light for best results, such as that produced by passing light through a tissue. Poor spectra could be due to glare, multiple reflections, extraneous light or dirt.

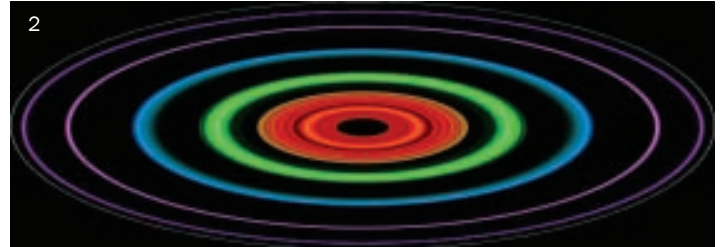
Good results could be obtained by placing the spectroscope in the tube of a microscope instead of the eyepiece. A piece of polaroid sheet could be used to separate the ω and ϵ rays. With some materials there can be a dramatic difference between the ω spectrum and the ϵ — for example with pezzottaite.



Antoinette Matlins (left) and Kerry Gregory enjoy an impromptu CCF session following the conference dinner.

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Modern digital photography works well for photographing spectra and indeed, when a triphosphor-coated tube is used as a lighting source, its characteristic emission spectrum (2) allowed a spectroscope to be calibrated by counting pixels in a digital photograph and then working out a nanometre to pixel conversion. Gems and minerals with rare earth spectra can be used in a similar way. Details of this type of calibration and John's database of spectra can be found on his website www.gemlab.co.uk.

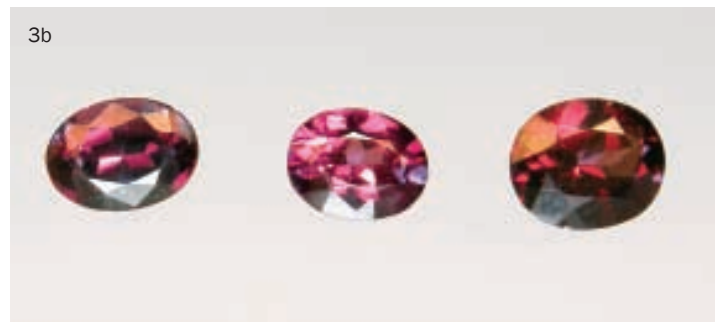


Changing before your eyes

In the next presentation, another aspect of colour in gemstones was described in detail when **Dr Karl Schmetzer** discussed 'Colour change garnets — causes of colour, colorimetry and extent of colour change'. His main focus was on colour-change garnets from Madagascar (3a and b), the first stones from this country that had been known since the end of the 1990s. The challenges were to find a way to describe the colours and the colour change, what caused the colour changes and how the extent of colour change might be best communicated.



The garnets in question fitted into the pyrope-spessartine series with vanadium, chromium and manganese as the main colouring agents. However, different colour-change effects did not clearly relate to simple trace element contents, e.g. not simply to the amounts of vanadium and chromium present. The garnets could have similar absorption bands, but although the spectrum patterns remain similar, the V-Cr-maxima were slightly shifted. This was seemingly due to lattice expansion with increase in vanadium and chromium contents, and also due to some replacement of magnesium by calcium. The best correlation for predicting colour on the basis of composition was Mn: (V+Cr), the best correlation for predicting the extent of colour change was the sum (V+Cr).



As noted in the summary of Karl's work on these colour-change garnets from Madagascar (see pages 38 and 39), he found that the colour changes could be plotted clearly and usefully on a two-dimensional chart. On the basis of the degree of colour change, the phenomenon could be described as 'faint', 'moderate', 'strong' and 'very strong'. In effect, 'faint' meant only a slightly noticeable colour change and Karl proposed that a specific type of chrysoberyl found in the trade with a colour change from green to grey was perhaps more fairly called 'colour change chrysoberyl' than alexandrite.



Gem wiz

The colour theme continued after lunch when **Dr Menahem Sevdemish**, the inventor of GEME Wizard®, presented 'Digital gem colour communication and analysis'. The growth in internet commerce has made it essential to have some way of accurately and consistently communicating colour. This computer-based method of describing colour has representations of 31 hues, each in 36–40 saturations. In the more sophisticated GEME Pro™ version (4), each hue is further divided into 5 — thus providing some 72,000 colours in total. The system includes the GEME Sampler™ component, which

2. Emission spectrum of triphosphor fluorescent lamp. Photo courtesy of John Harris. 3a and b: Colour-change garnets in daylight (a) and incandescent light (b). Photos © Karl Schmetzer. 3. Sample tone and saturation combination grid of red colour of the GEME Wizard®. © GEME Wizard.

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Gem-A Conference 2009 (cont.)

analyses the digital images of a gem, defining the specific hue and corresponding red/green/blue (RGB) proportions.

The suite of products developed by GemeWizard® was designed to meet specific needs of particular segments and professionals of the trade with an emphasis on internet activities, pricing systems and trading platforms.

The software allows rapid and accurate comparison of colours. It is ideal for communicating colour and for teaching gemmologists or stone dealers about colour.

Menahem stressed that modern flat-screen monitors have fairly consistent colour reproduction and can be easily calibrated for more stringent colour characterization.

Gee wiz

Alan Hodgkinson next presented a pot-purri of gemmological aspects in 'Putting the Gee back in gemmology'. With his inimitable enthusiasm and experience for the subject he explained both the necessity for gemmological knowledge and experimentation, and how basic equipment could be used to provide useful information. For example, zircon could be distinguished from the man-made material lithium niobate (5) on the basis of their relative birefringence and dispersion — what Alan referred to as their b:d ratios: zircon ~1.5, lithium niobate 0.7. With top lighting, a refractometer can also show the pleochroic colours of a gem and thus the relationship between RI and the relative dichroic colour of each ray.

The origin of the 'Visual Optics', for which Alan is well known, was traced back to the late nineteenth century, when a large colourless diamond in Paris was in doubt. The stone was denied its diamond identity on the basis of the 'doubling' of a candle flame when held close to the eye, the method was developed to a much higher level by the speaker, who gave the technique the name 'Visual Optics'.



The elongate lithium niobate doubled primaries (b:d 0.7) are instantly separated from the zircon primaries in which the doubled primaries are quite separate at a b:d ratio 1.5. Photograph by Alan Hodgkinson.

A new Comparative Hanneman Reflectivity Meter was shown to have a range of gemmological diagnostic benefits, as reflectivity is closely related to the sequence of refraction. Control stones enable much useful determinative or elimination work to be undertaken. YAG is thus easily separated from GGG.

The new powerful rare earth magnets have gemmological uses in addition to detecting the majority response of synthetic diamonds (apart from Sumitomo). They make a useful contribution to distinguishing between the pyrope, almandine and spessartine garnets (see *The Journal of Gemmology*, 2007, **30**(7/8), 454–55). The powerful response of GGG to such a magnet immediately separates it from YAG. This is the more critical when it was shown how many colours exist of these two synthetic garnets.

Talk of simulants brought Alan to an unusual gem identification puzzle — how do you convert a spinel into a much rarer taaffeite? Cutting the table of a spinel so that it actually had two planar surfaces at an angle of just 1 or 2 degrees to each other, causes a refractometer to give an anomalous indication of double refraction. Spinel is singly refractive with an RI of 1.719 while taaffeite has an RI of 1.717–1.724 with a birefringence 0.004–0.005.

Alan also was a fan of less common gems which are rarely used in jewellery because they are considered too soft. A fine example was provided by a mouth-watering yellow anglesite, Mohs' hardness 5.5–6. A range of exquisite fluorites was also shown, many from England and faceted by Doug Morgan and Jim Finlayson. These have a hardness of 4, which seems to cause the jeweller to have a fit and yet the trade happily make a handsome profit from pearls (cultured) the hardness of which is only 3–3.5! Surely such fine gems can be set in pendants, brooches or earrings?

Coloured diamonds

From unusual gems and some less conventional methods of examining them, the subject moved to diamonds when **Thomas Hainschwang** presented 'Optical and spectral characteristics of exotic natural fancy colour diamonds'.

Thomas explained that diamonds were known in most colours of the rainbow, some extremely rare, others less rare. Absolutely pure diamond is colourless, but intrinsic defects, such as lattice effects, and extrinsic defects such as the presence of boron or nitrogen, affect their colour. For example, when a diamond contains sufficient N3 centres (three nitrogen atoms surrounding a vacancy) with associated N2 centres, it is yellow in colour. A small amount of boron present causes a blue to grey colour. In addition to explaining the various colours encountered in diamonds and their causes, Thomas described the techniques used to characterize diamonds and distinguish natural fancy coloured diamonds from treated and synthetic diamonds.

The main techniques used for characterizing coloured diamonds were UV-Vis and FTIR spectroscopy — which, respectively, look at the ultraviolet plus visible part of the spectrum, and the infrared part of the spectrum. Photoluminescence was also used. The characteristic