6 October 2008

A report on synthetic tourmaline in the current market!

An unexpected find made during our research on bulk diffused tourmaline!

During our ongoing investigations into the bulk diffusion of heavy metals into tourmaline, we have stumbled onto a totally unexpected situation that we wish to report to the industry. That issue: what we believe to be the first confirmation in the markets of Synthetic Tourmaline.

The situation first presented itself when we were running Raman scans of the more than 200 specimens of tourmaline in the ISG Gem Research Center . During this process we found 28 tourmalines, 20 pink, 6 green, 1 blue and 1 colorless, that gave Raman shifts that were totally unique and unlike any of the other known natural tourmalines. At right you see the 28 specific specimens in this tray. The unusual tourmalines are turned on their sides in their holder.

We performed over 140 Raman scans on these 28 tourmalines to insure that we had all possible orientations viewed. We also scanned other known tourmalines that have been in our possession for anywhere from 2 weeks to 20 years, including those recently obtained from both Brazil and Mozambique . The findings were the same. These 28 tourmalines give significantly different Raman scans that were repeatable time after time, and unique to these 28 gemstones.

During this process we also noted four significant features about this group. First, all of the specimens were less than one carat in size. Second, with the exception of one specimen all are flawless or virtually flawless. Third, the one exception of the clarity showed remarkably similar inclusions to a hydrothermal emerald we have in the ISG office that was cut very close to the seed plate. And finally, all of the specimens showed remarkable results in an immersion cell that very closely resembled the diffusion formations of the andesine we recently studied. A colorless tourmaline in this group is shown at left. We used this specimen as our control stone for the testing photographs.

The idea of synthetic tourmaline on the market was put forth in in the 1999 edition of **Gems and Gemology, GIA, Fall 1999, Volume 35, Issue 3,** when **Dr. Kurt Nassau** stated, "Hydrothermal synthetic tourmaline and topaz may become available, but they probably will not be economically viable in the near future." Of course, this article was written nine years ago and much could well have happened to make this a reality in today's market.

As a result of the above comments from Dr. Nassau, and our own anomalous tourmaline test results, members of our group researched the identification of synthetic tourmalines and found an astounding article written in 1993 by the Institute of Geochemistry and Physics of Minerals, Academy of Sciences of Ukraine entitled: Optical absorption spectroscopy of synthetic tourmalines. In this article it is noted that **"An additional intensive absorption band 12500 cm^{-1} (-polarisation) appears in some specimens but is not yet found in spectra of natural tourmalines."** And as will be noted later in this report, our 28 unusual tourmalines all exhibited an intensive absorption band at that same

wavelength as reported by the Russians for synthetic tourmaline, and not seen in natural tourmaline. A point that we also confirm as this intensive absorption wavelength has only been found in the 28 tourmalines, not in any other known natural tourmaline in our study.

As we always do with these reports, we will let the images speak for themselves. Below is the over view of images that demonstrate the basis of this report.

Identification of Tourmaline

As we always do, we photographed the actual testing of the stones to best document our findings.

The 28 tourmalines all showed remarkably clear uniaxial interference figures in the polariscope, and all dead on center to the table of the stone.

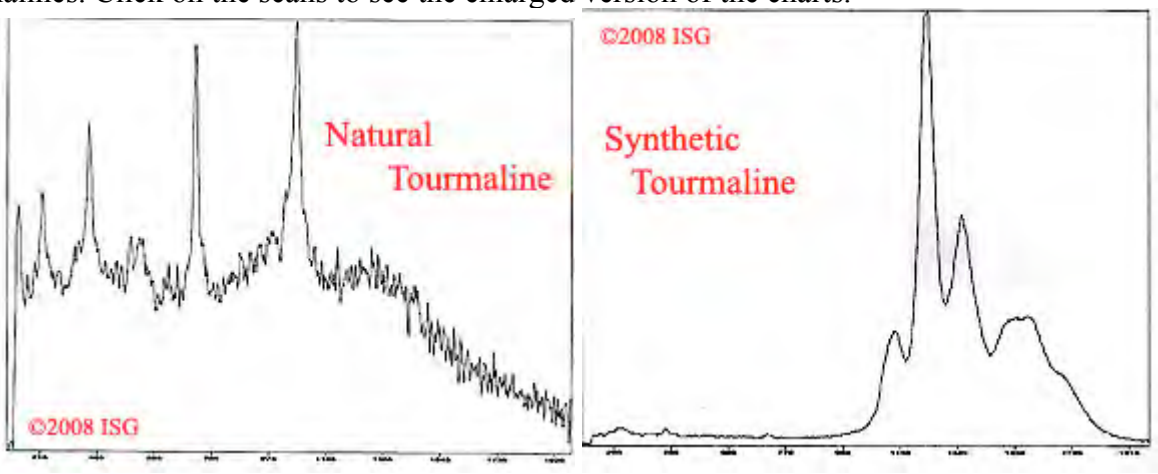
The refractometer confirmed the uniaxial optical character of these tourmalines, along with the negative optical sign as demonstrated below with the actual images of the refractometer readings.

And to complete the confirmation we preformed hydrostatic specific gravity which showed a spot on reading of 3.06 specific gravity to confirm the identification of these stones as tourmaline.

The Anomalous Reactions

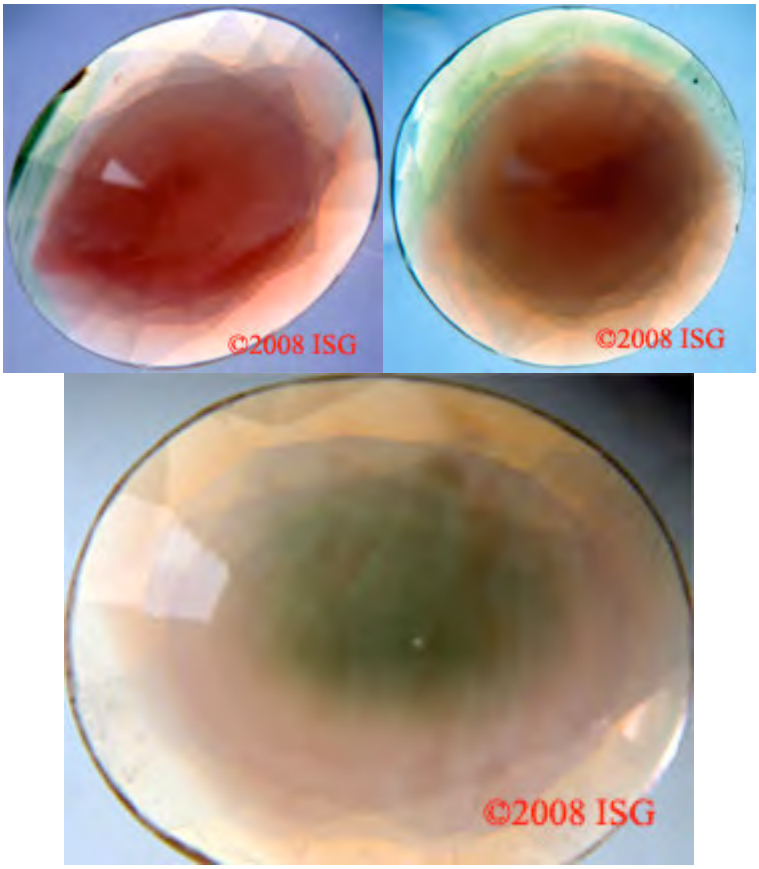
Raman Microscope: Upon additional testing we found the results that exposed this material as being anomalous to natural tourmaline. The first being a very unusual Raman shift that was the result of scan after scan on stone after stone and in all directions of orientation. Below left is a Raman scan

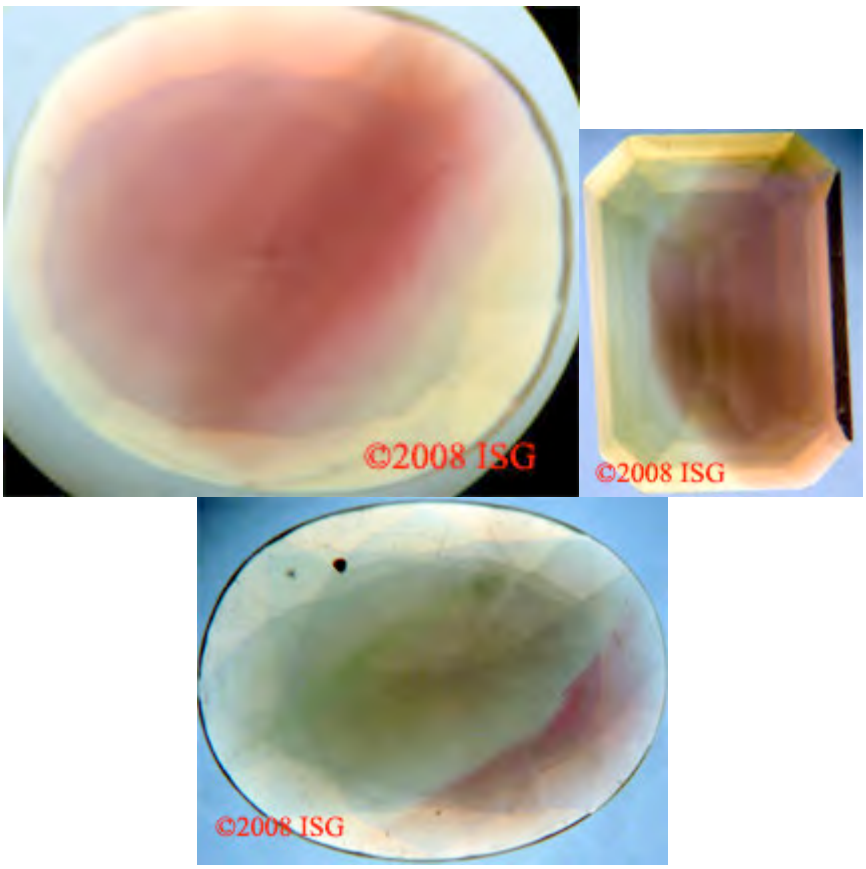
of natural tourmaline, and below right is the Raman scan that is shown on all of the 28 anomalous tourmalines. Click on the scans to see the enlarged version of the charts.



We should note that the intense peak at the 1250 (cm-1) on the synthetic tourmaline scan is the same peak referred to in the 1993 Russian report for synthetic tourmaline. That peak does not appear on any of our known natural tourmalines, as also reported by the Russian report.

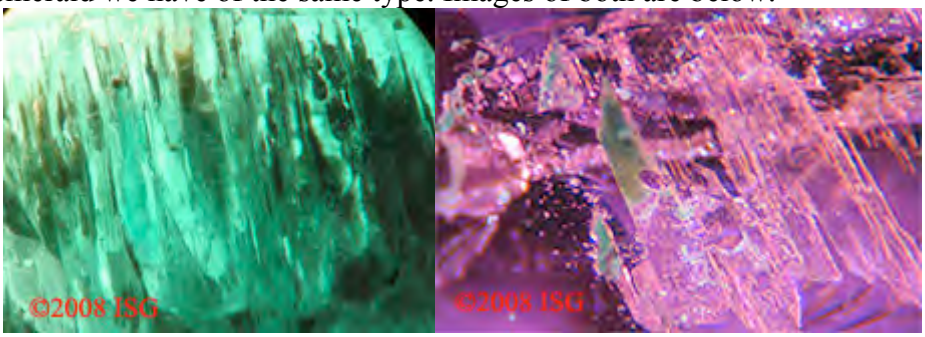
Immersion Cell: The immersion cell produced astounding results, as the reactions appeared very much like those seen earlier with the bulk diffused feldspar. All of the stones, pink and green, exhibited unusual color zoning with both red and green colors showing in patterns that are both arbitrary and unlike anything seen to date in natural tourmaline. Please note, none of these stones show a watermelon pattern as would be expected with these color zones. You can see these stones in the banner of this edition of the newsletter.





Magnification

There are two issues that became obvious when looking at these 28 tourmaline specimens. The pinks and reds, which should have had characteristic inclusions, were all either flawless or virtually flawless. The one anomaly that we found was a pink stone that was so included that it required special attention….mainly because the inclusions in this stone very closely emulate the inclusions in a hydrothermal emerald we have that are due to the stone being cut very close to the beryl seed plate. And additional Raman scanning of this stone in various orientations produced a specific location that gave a natural tourmaline like Raman shift. Which indicates to us that this one heavily included stone with the anomalous Raman readings in all but a limited orientation, with hydrothermal plate type inclusions, is a synthetic hydrothermal tourmaline that was cut very close to the seed plate, just as the hydrothermal emerald we have of the same type. Images of both are below.



Conclusion

It is our conclusion that the unusual tourmalines in the ISG office are most likely hydrothermally grown synthetic tourmalines as outlined by the Academy of Sciences of Ukraine in their 1993 report, and referred to by Dr. Kurt Nassau in the 1999 **Gems and Gemology** article. Our Raman shift scans

have been repeated on stone after stone and orientation after orientation, and all results have been identical for these stones. We also suspect and will continue to test to confirm that the hydrothermal tourmalines are diffusion treated to impart the color seen in the immersion cell.

And as is always the protocol for the ISG Gem Research Center , we continue to purchase additional specimens wherever and whenever possible, investing a significant amount of our revenue into research.

Today, as I wrote this article, the postman brought yet another specimen as shown below that tests out exactly as the original 28 specimens. This is a 1.19 carat oval tourmaline of intense pinkish red color, and totally flawless. (Dust particles appear on the image due to time constraints of meeting this deadline). You can click on the tourmaline image to see the actual Raman Microscope scan of this stone done just a few minutes before sending of this report.

It is obvious that the hydrothermally grown synthetic tourmaline is very easy to identify with Raman technology. (Thank you Eric Wu and all of the folks at Enwave Optronics for making Raman technology affordable to more gemologists).

As I stated earlier, we were not looking for this situation when we were studying the heavy metal bulk diffusion of Mozambique tourmaline. But in gemology, you never know when the next revelation is going to appear.

This one was a total surprise, but one that is easily identified here in the ISG office.

With Appreciation: To **Lisa Brooks-Pike** and **Veronica Poteat** for your excellent research. You all astound me with just how much information you can find in so many obscure places. Well done to you both!

Robert James FGA, GG
President, International School of Gemology