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New type of emerald composite

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In a packet of some 82 natural emeralds submitted to our laboratory for certification there were three stones which showed unusual assemblage of inclusions consisting of crystalline mica flakes, two phase inclusions as well as prominent gas bubbles. Two of these stones weighing 3.24 carats and 4.17carats are shown in Fig.1. The refractive indices determined on the table facet were like text book figures of any standard emerald 1.57-1.58 for one stone and 1.58-1.59 for the other stone. But the SG was just 2.64! These are Emerald Composites: The central preformed portion was a very pale green coloured natural beryl (Fig.2) and on all four sides of the table facet were pavilion facets made of green transparent glass (Fig.4).

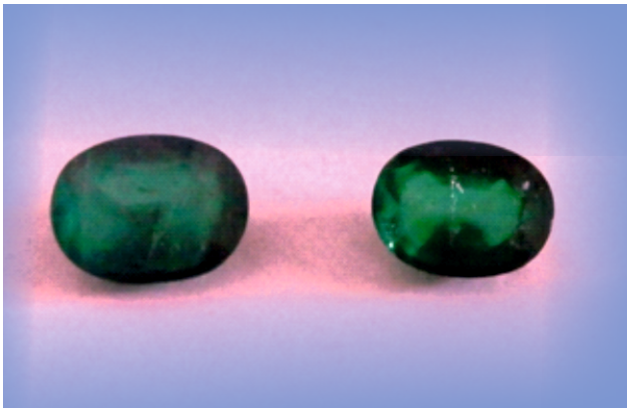

Fig.1: Emerald Composites 4.17 and 3.24 carats

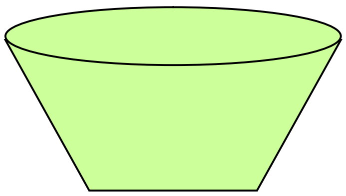

Fig 2 Schematic representation of preformed beryl

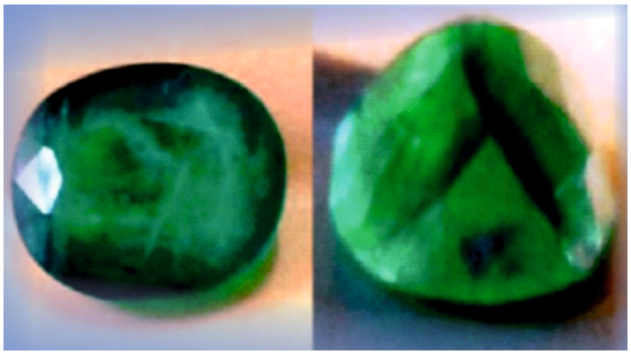

Fig.3: Front and side view of 4.17carats stone in torch light

Fig. 4 Centre piece beryl with glass on all sides

When these stones were observed from the side with a torch light they showed very clear junction lines of glass pieces attached on the pavilion portion (Fig.3). With the permission of the client one composite stone was dismantled and 4 individual pieces of glass along with a central portion of preformed pale green beryl were obtained (Fig.4).

Gas bubbles were seen in the darker green portion on the side whereas through the table facet liquid filled veils and crystalline inclusions typical for beryl were observed (Fig. 5 and Fig.6). The UV-Vis spectroscopy showed totally different absorption spectra for the emerald composite as compared to the absorption spectra of a natural emerald (Fig 7). Also the FTIR spectra (Fig.8) for the emerald composite were totally different as compared to that of a natural emerald.

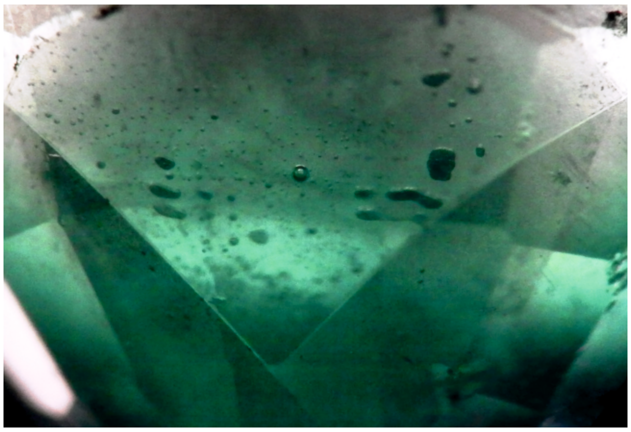

Fig.5: Gas bubbles seen in the glass portion

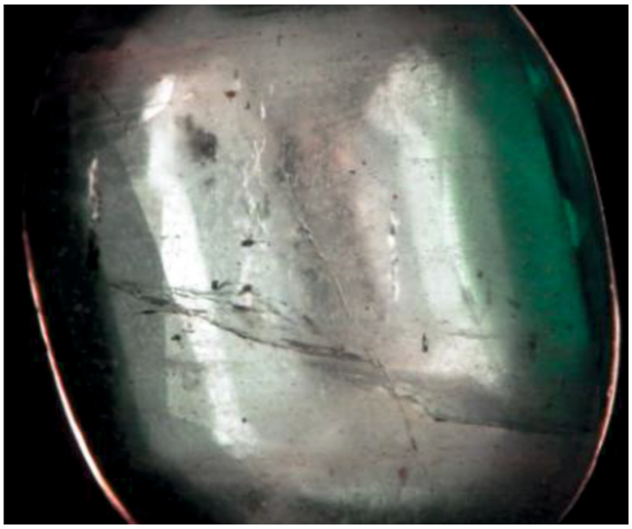

Fig.6: Fluid and crystalline inclusions in table portion

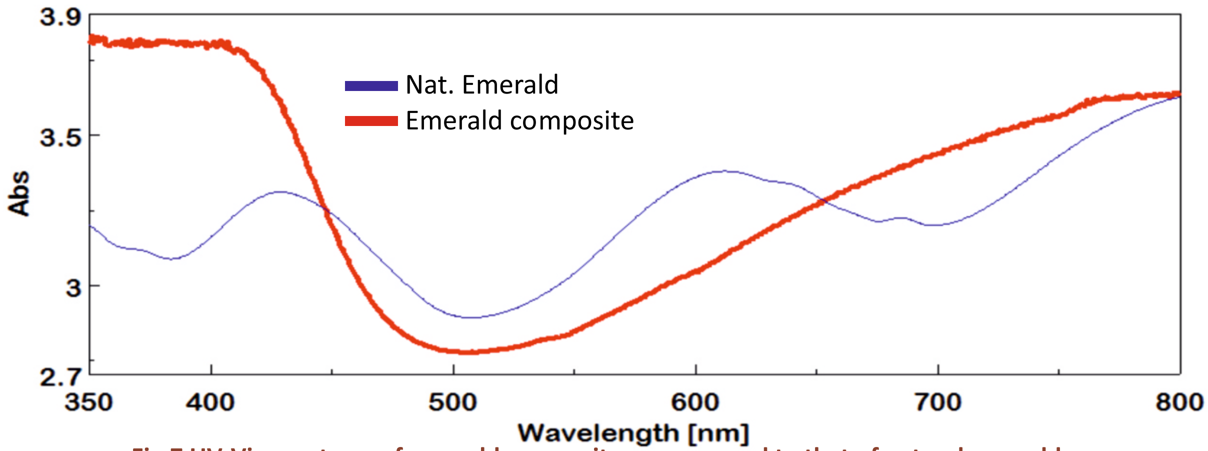

Fig.7 UV-Vis spectrum of emerald composite as compared to that of natural emerald

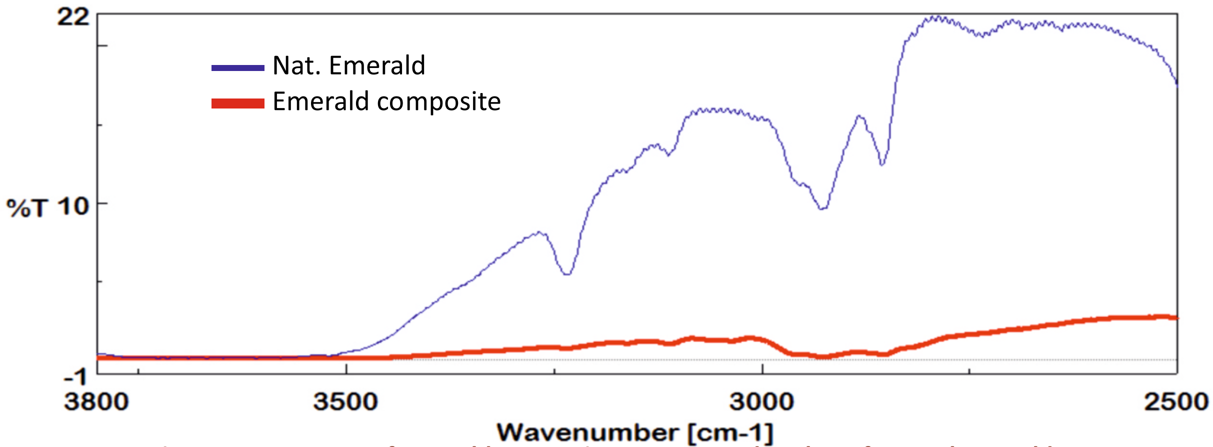

Fig.8 FTIR spectrum of emerald composite as compared to that of natural emerald

Conclusion:

Composite stones have been known since long. Soudé emeralds are also known with beryl and quartz combination in which the different parts are adhered parallel to the table facet. It is the first time that a composite emerald has been observed made of natural pale green beryl along with four pieces of green glass glued with some resin. In a closed setting such a composite emerald would be a problem to identify as the RI and inclusions could be deceptive.

Unusual Hydrothermal Synthetic Emerald, with filled fractures

By Hyunmin Choi, Sunki Kim and Youngchool Kim

Hanmi Gemological Institute & Laboratory, Seoul, Korea

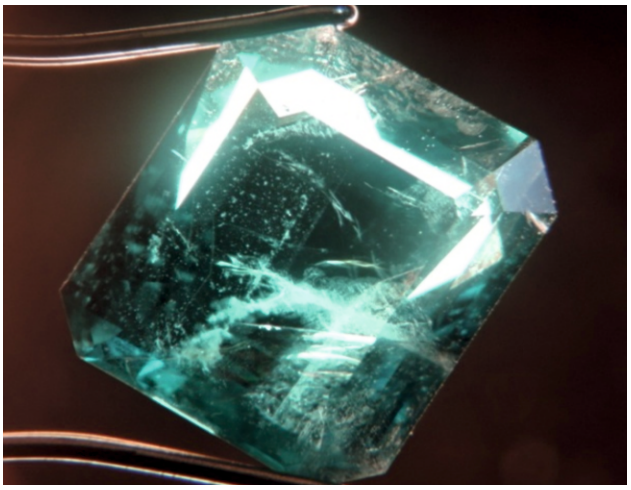

Fig 1

Fig 1 and Fig 2: The 4.75ct hydrothermal synthetic emerald submitted for identification to Hanmi lab

The Hanmi Laboratory recently received for identification what visually appeared to be high-quality, fine-color emerald of 4.75ct (Fig.1 and Fig 2). In process of testing, we found fractures filled with a foreign material (Fig. 3).

Today, natural and synthetic emeralds from a variety of sources are seen routinely. A gemologist usually uses magnification, chemical analysis, infrared and Raman spectroscopy to separate natural from synthetic emerald, or to determine the geographic origin of a natural stone or the growth technique of a synthetic emerald.

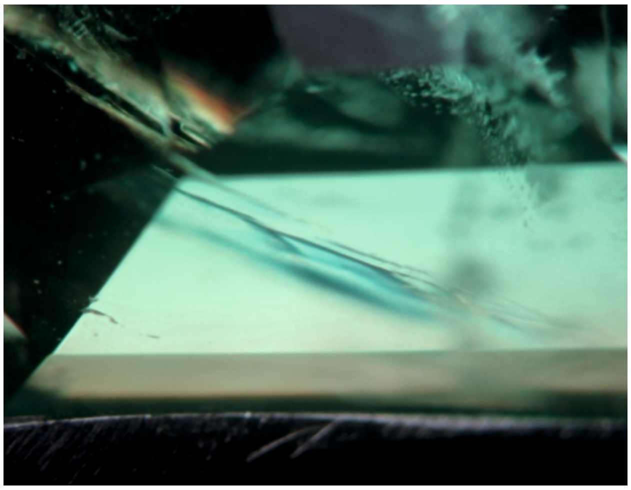

Fig.3. Filled fractures viewed across the width of this hydrothermal synthetic emerald produce a clearly visible greenish blue flash effect in dark field illumination.

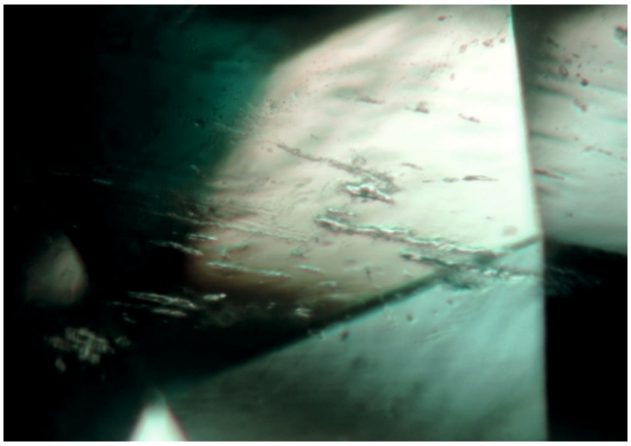

Fig.4. Two-phase (liquid/gas) inclusions were observed in the synthetic emerald

Initial tests of the 4.75ct emerald showed typical characteristics of natural emerald. “Fingerprints” and two-phase (liquid and gas) inclusions were observed with a gemmological microscope (Fig. 4). These inclusions are similar to those observed both natural and synthetic emeralds. So, we couldn’t consider them as an evidence of synthetic or natural origin.

Non-polarized UV-Visible absorption spectrum of 4.75ct emerald confirmed the presence of Cr^{3+} two broad bands at 425 and 620 nm; and a doublet at 681/684 nm, similar to natural and synthetic emeralds (Fig. 5).

Chemical analysis by EDXRF revealed aluminum and silicon as major elements, with minor amount of chromium, iron and trace vanadium. Unlike some hydrothermal synthetic emeralds, this sample did not show any chlorine.

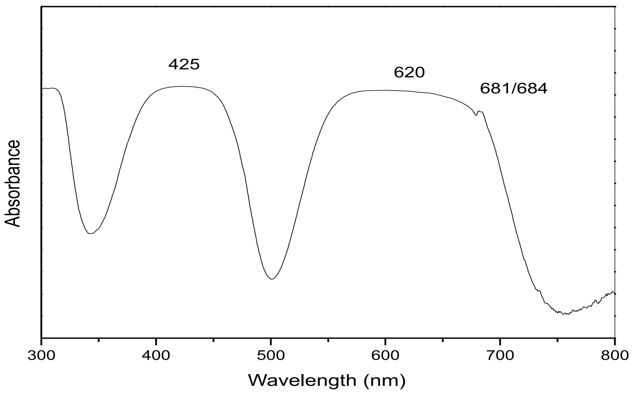

Fig.5 Non-polarized UV-Visible absorption spectrum of 4.75ct emerald

Mid-infrared spectra (4000-2000 cm^{-1}) in diffuse reflectance mode are shown in Fig.6. A series of intense peaks between 4000 and 3400 cm^{-1} in this emerald is related to their high water contents. Such features are characteristic of both natural and hydrothermal synthetic emeralds, but they are not found in flux synthetic samples. Band in the range 3100-2500 cm^{-1}, commonly used to identify hydrothermal synthetic emeralds from Biron, Linde-Regency and Malossi (Adamo et al.), was not observed in the 4.75ct emerald (Fig.6). Material related filling was detected at 3033, 2963, 2932 and 2870 cm^{-1}. Several additional peaks shown at 2686, 2672 and 2641 cm^{-1} have never been documented in the literature for synthetic emerald before.

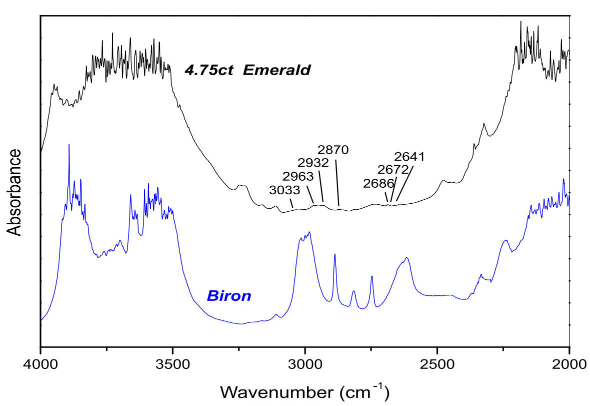

Fig.6. Mid-infrared spectra (4000-2000 cm^{-1}) in diffuse reflectance mode are shown for the 4.75ct sample and for Biron hydrothermal synthetic emeralds tested for this study.

Raman spectroscopy is useful to classify water types in the structural channels of emeralds and to differentiate natural vs. synthetic emeralds. Spectra were collected in the range of OH- and water molecule vibrations (3500-3700 cm^{-1}, Fig.7).

As shown in Fig.7 the presence of Raman bands at 3608 and 3598 cm^{-1} is diagnostic of natural emeralds. On the contrary, hydrothermal synthetic 4.75ct emerald has only the 3608 cm^{-1} band. According to the published literature (Huong et al., 2010), band at 3608 and 3598 cm^{-1} were seen in the Raman spectra of all the natural emeralds, with varying relative intensity. The hydrothermally grown synthetic emeralds showed just one band at 3608 cm^{-1}. Huong et al. reported that the 3598 cm^{-1} band was detected only in the alkali-(high or low) containing natural emeralds. Alkali-free hydrothermal synthetic samples, however, this band disappeared while the 3608 cm^{-1} band persisted.

Non-polarized UV-Visible absorption spectrum of 4.75ct emerald confirmed the presence of Cr3+ two broad bands at 425 and 620 nm; and a

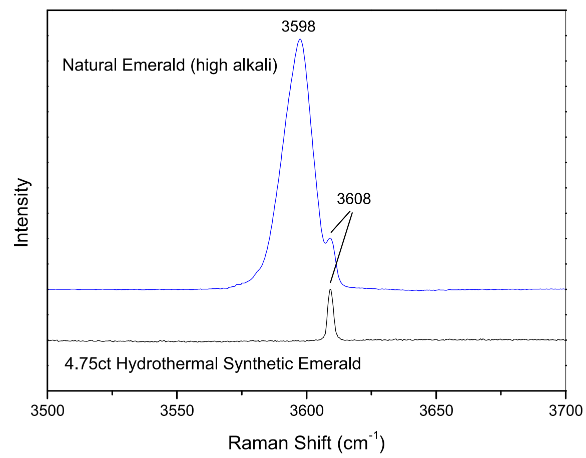

Fig.7.The Raman spectra of emeralds in the water range from 3500 to 3700cm^{-1} are shown here. Natural emerald shows two Raman bands, at 3598 and 3608 cm^{-1}. Hydrothermal synthetic emerald shows one Raman band, at 3608 cm^{-1}.

Summary :

An unusual type of fracture filled hydrothermal synthetic emerald was submitted to our Hanmi laboratory. This case is the first experience of hydrothermal synthetic emerald with filled fractures in our laboratory. The 4.75ct emerald could be distinguished from its natural counterpart on the basis of Raman spectra.

References

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2. Huong L.T., Häger T., Hofmeister W. (2010) Confocal micro-Raman spectroscopy: A powerful tool to identify natural and synthetic emeralds, G&G, Vol. 46, No.1, pp.36-41.

Soudé-emeralds – Good imitations in modern times

By Tay Thye Sun & Loke Hui Ying

Far East Gemological Laboratory, Singapore

Soudé-emeralds or quartz doublets are traditionally made up of two pieces of rock crystal forming the crown and pavilion of the stone cemented together by a green-coloured layer of gelatin. Made to imitate emerald and were therefore called soudé-emeralds from the French émeralde soudé (soldered emerald) (Webster, 2003).

Fig.1. Two pieces of Soude Emerald with 26.27 carats (left) and 7.86 carats (right) (Photo by Tay)

Two soudé-emeralds were examined closely from our institute collection. The bigger one weighs 26.27 carats and smaller one weighs 7.86 carats (Fig.1). In both stones the refractive indices are similar type i.e. the crown facet R.I. reading is 1.520 and pavilion facet R.I. reading is 1.540 – 1.550 and the S.G. determined was 2.58 – 2.59. Therefore, it is unlike the early soudé-emeralds reported as quartz doublet, this one is glass/quartz doublet. Both stones turn pink when view through the Chelsea filter and under the long and short wave ultraviolet light, both stones show weak to moderate yellowish-green fluorescence. Strong thick absorption band at 630-650nm indication of artificial green colouring was observed through a table top prism spectroscope. Under microscopic observation, there are tiny rounded and tube like flatten gas bubbles along the joint plane and also polishing mark could be seen (Fig.2).

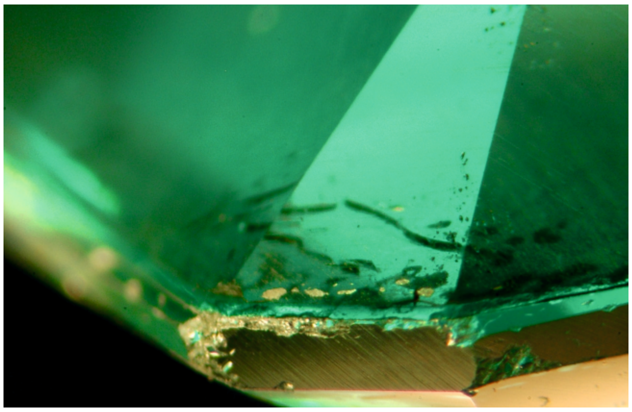

Fig.2. Flat type of gas bubbles in tube like appearance could be observed along the joint plane with green colouring (Magnification 20x, Photo by Tay)

On immersing the doublets inside a beaker of water, in a reduced lighting condition, colourless layer of quartz could be seen clearly with green layer material (Fig.3).

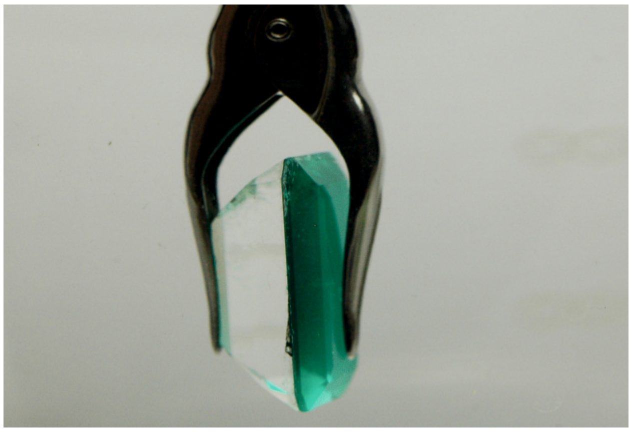

Fig.3. Colourless pavilion layer as seen here when the doublet was immersed in water (Photo by Tay)

Discussion:
Soudé-emeralds have evolved since 1920s with earlier material being quartz doublet and much later the unstable gelatin layer has been replaced by a layer of coloured and sintered glass or similar colouring material. Our finding has shown that it is no more quartz doublet instead glass/quartz doublet and the colouring is very much a metallic oxide as the S.G. of these doublet of glass/quartz is much lower than 2.8 reported in some of heavy lead glass of coloured layer (Webster, 2003).

Impregnated Russian Hydrothermal Synthetic Emerald

Kook-Whee Kwak and Eun-Ah Jeong

Wooshin Gemological Institute of Korea

An emerald with a vivid green color was recently submitted to the Wooshin Gemological Institute (Fig.1). The emerald-cut loose stone weighed 1.50ct. Standard gemological testing gave a refractive index of 1.572 ~ 1.578 with a birefringence of 0.006, and a specific gravity of 2.70; values in the overlapping range of natural and synthetic emeralds.

The specimen appeared weak red through Chelsea filter, was inert to short-wave UV. However, a bluish white fluorescence appeared from fractures under long-wave UV, suggesting that the fractures were impregnated.

Fig.1. 1.50 ct emerald

Microscopic examination revealed V-shaped growth pattern (Fig.2), a typical feature of Russian hydrothermal synthetic emeralds. Opaque black hexagonal platelets and a number of tiny reddish brown particles were observed (Figs.3 and Fig.4). Such inclusions are also known to be seen in Russian hydrothermal synthetic emeralds[1].

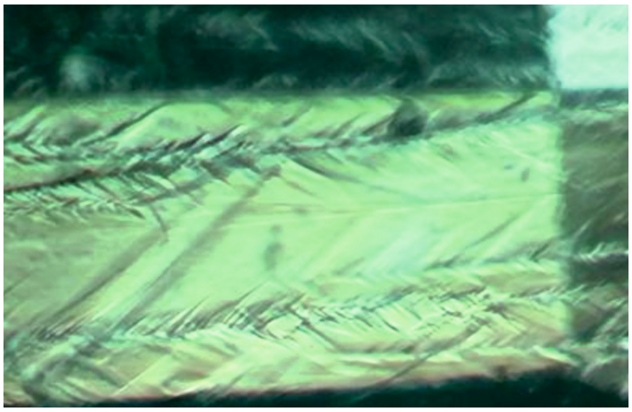

Fig.2.V-shaped growth zone observed in the 1.50ct emerald

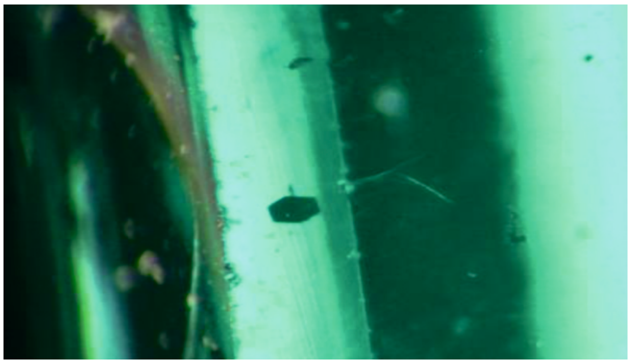

Fig.3. A black hexagonal platelet inclusion

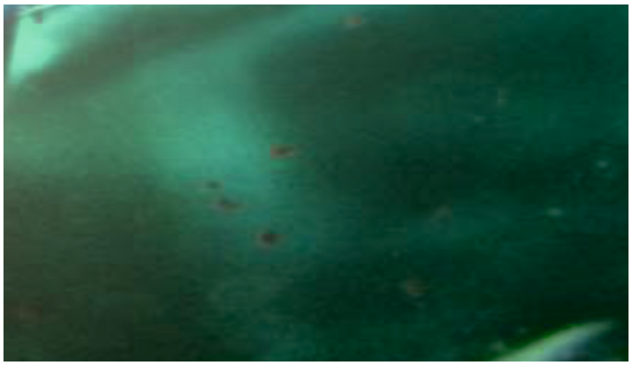

Fig.4.Tiny reddish brown particles observed in synthetic emerald

Spectroscopic examinations also support that the specimen is an impregnated synthetic emerald. The infrared spectrum showed weak peaks at 2320, 2440cm^{-1} (Fig. 5), but no peak at 2290cm^{-1}. The 2290cm^{-1} peak is known to be usually present in natural emeralds. Also, strong absorption peaks in the 2700 ~ 3000cm^{-1} range indicate the impregnation of the stone.

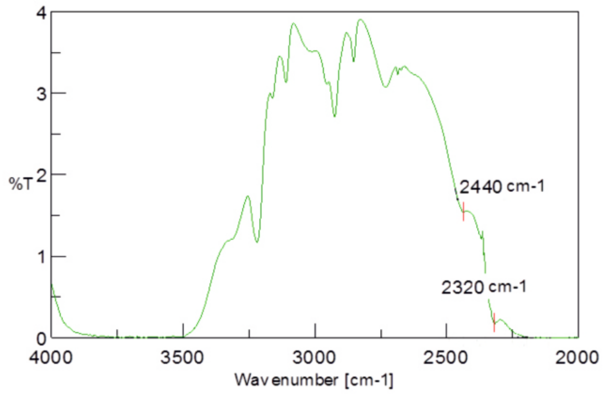

Fig.5. FT-IR absorption peaks at 2320, 2440cm^{-1} and in the 2700~3000cm^{-1} range

In the UV-Vis-NIR spectrum, the sharp peak at 373nm (Fe^{3+}) and the broad absorption centered at 750nm (Cu^{2+}) suggest that the stone is a Russian hydrothermal synthetic emerald (Fig.6)[2]. Moreover, FT-IR absorption peaks in the 2700~3000cm^{-1} range along with the fluorescence from fractures under long-wave UV suggest that the Russian synthetic emerald has been impregnated.

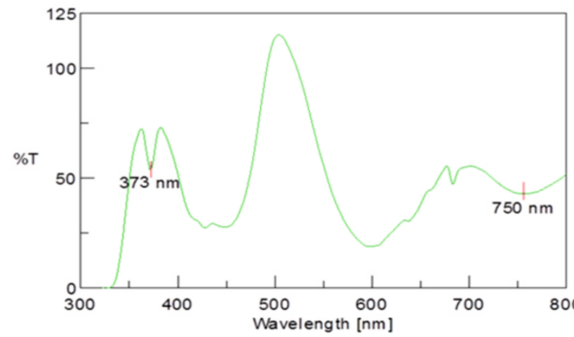

Fig.6. Fe and Cu-related absorptions in UV-Vis-NIR Spectrum

References:

[1] Koivula J., et al. (1996) :
Gemological Investigation of a New Type of Russian Hydrothermal Emerald. Gems & Gemology, Vol. 32, No.1, pp. 32-39.

[2] Schmetzer K. (1988) :
Characterization of Russian hydrothermally grown synthetic emeralds. Journal of Gemmology, Vol. 21, No. 3, pp. 145–164.

Introducing Regular Member 007:

Mr. Travis Lejman

Gemmological Qualifications of the Owner:

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Full Name of the Laboratory:

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What Advanced Instruments do you have:

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Have you published or presented papers at conferences/magazines/seminars?

Wrote articles for the NAJA (National Association of Jewelry Appraisers) News Letters, Also attended NAJA: 28th ACE©It Annual Mid Year Conference Atlanta, GA 2007; 34th ACE©It Annual Mid Year Conference Warwick, RI 2010; 35th ACE©It Annual Winter Conference Tucson, AZ 2011; 37th ACE©It Annual Winter Conference Tucson, AZ 2012; 38th ACE©It Annual Mid Year Conference Bellevue, WA 2012; 39th ACE©It Annual Winter Conference Tucson, AZ 2013.

Do you have any other Experience? Worked as a Gemologist and Appraiser Determined a retail value for various jewelry items and loose gemstones; Graded Color and Clarity of Diamonds; Gemstone Identification; Watch Certification.

Are you a Member of a Gem Trade Organization?

GIA Alumni & NAJA (National Association of Jewelery Appraisers

Are you giving lectures and educational programs to trade?

Yes, Tutoring proper equipment handling to some students taking their G.G. test

Members of ICGL
met at Chiang Mai, Thailand on 7th December 2014

In December 2014 members of the International Consortium of Gem Testing Laboratories met at a dinner meeting arranged by Mr. Henry Ho of Asian Institute of Gemological Sciences at the Holiday Inn in Chaing Mai, Thailand.Mr.Kennedy Ho and Ms. Oratai of AIGS were present. ICGL Members present were from Singapore Tay Thye Sun and his family, from Japan Mr. Masaki Furuya, from Korea Mr. Sunki Kim and Mr. Kook Whee Kwak and from India Dr. Mrs. Jayshree Panjikar.

It is two years since ICGL was established, the member laboratories have benefitted from each other as there is constant interaction between members regarding new developments in treatments and synthetics observed in individual laboratories. Henry Ho, of AIGS spoke about the Power of Communication and how ICGL can be made to focus so that it can reach out to retailers as well as wholesalers, while the ICGL members remain the core group. As everyone is looking out for quality, value and service, ICGL can offer these to the public by sharing our knowledge with the retailers and consumers. ICGL can be the best platform as it represents laboratories from almost all the continents. Various points were discussed especially on how to be more effective in the global scenario. Suggestions from members were taken and an action plan has been formulated.