

## LAB INFORMATION CIRCULAR

### Emeralds from Jharkhand

*- a preliminary examination*



*Figure 1: Emerald rough from Jharkhand in a range of colour, transparency and size*

#### **The background...**

It was December 2013, when the news about emerald deposits in the state of Jharkhand broke out in the market and within few months time, some large quantities of these emeralds were already being mined. The deposit initially attracted attention because of the reports in local media about arrests for illegal mining and smuggling. In no time, these emeralds became quite popular in the local market and many traders have shown interest in these stones. As per a report published in the Journal of Gem & Jewellery Industry, Vol. 51, No. 5, "over 5,000 skilled and unskilled miners are digging nearly 15 kg of precious stones (emerald) per day". However, at the Gem Testing Laboratory, we have seen only few of these emeralds, while at least 65% of stones tested at the laboratory are emeralds. Although, we have seen some large lots of Jharkhand emeralds, most of which are relatively small in sizes, less than 5 ct in rough. On initial observation of the rough and the specimens, it appeared that the mines have been salted, but later the geology department of the state confirmed the presence of emeralds in Jharkhand.

Emerald deposits in Jharkhand are located in Ghorabandha hills in Ghatshila sub-division of East Singhbhum district, bordering the state of Odisha (Orissa), which is already known for a variety of high quality gemstones. Mining in Jharkhand is carried out by local villagers, including children in at least 50 places and hence is illegal at this stage. However, the government of Jharkhand is working towards legalizing mining by seeking necessary approvals from the centre for reserving the mining areas for Jharkhand State Mineral Development Corporation. Meanwhile, these emeralds are gaining popularity amongst the traders and jewellers in Jaipur and hence, we also procured and studied few samples of these emeralds.



*Figure 2:  
Representative  
samples of cut and  
polished emeralds  
from Jharkhand.  
Note the difference  
of colour shade in  
two specimens*

### **Visual Characteristics**

The studied emeralds from Jharkhand displayed a range of colours from bluish green to yellowish green of medium to strong saturation (see figure 1 and 2). However, most of these emeralds are characterized by haziness i.e. the rough or cut stones are not absolutely transparent, while quite a few rough crystals appear blackish due to presence of some mineralic substance, making the stones appear opaque. Although, these can be removed during cutting and polishing, some still make their way into the cut stones, making them appear too dark or blackish. In addition, most of the rough crystals had frosty and etched surfaces, making it difficult to see inside for detailed analysis.

### **Basic Properties**

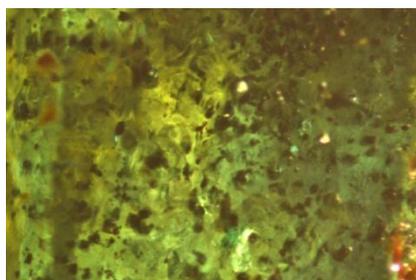
Gemmological properties namely, refractive index and specific gravity were measured at 1.580 - 1.588 and 2.70 - 2.71, respectively; displayed strong Cr-absorption in desk model spectroscope, and appeared inert under ultra-violet lamp and Chelsea filter.

### **Under the magnifying lens...**

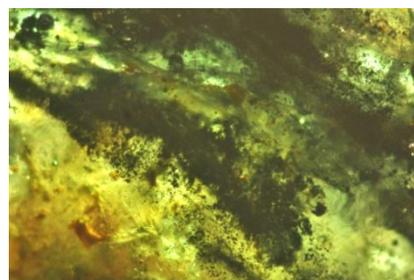
As mentioned above, most of these emeralds are characterized by haziness, caused due to presence of minute inclusions, which could not be resolved under standard gemmological microscope, however, appeared to be some colourless mineral. In addition, the most common inclusions were black grains (spinel group), which were present scattered throughout the stone, as well as in zones and planes. Further, few specimens also contained numerous colourless to white rounded crystals of phenakite, elongated blades of actinolite, mica plates and most strikingly rounded colourless grains of zircon with stress cracks (zircon halos). We have never seen a zircon halo inclusion in an emerald from any other source before; also we could not find any reference for such an encounter.



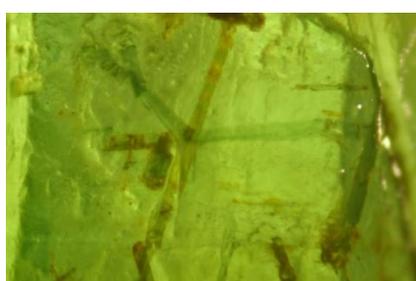
*Figure 3.a: Most of the Jharkhand emeralds appeared hazy due to presence of minute mineral inclusions.*



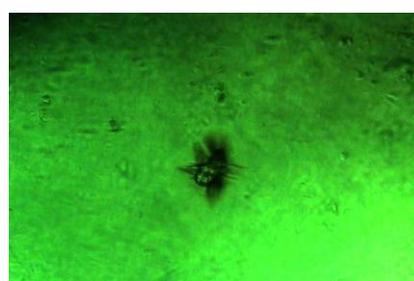
*Figure 3.b: Majority of Jharkhand emeralds contained black grains (spinel group), which were present scattered throughout the stone or in planes or zones. Similar inclusions have also been found in some Brazilian and Zambian emeralds too, which have been identified as chromite, magnetite or picotite (all spinel minerals).*



*Figure 3.c: These whitish to colourless crystals in Jharkhand emeralds have been identified as phenakite.*



*Figure 3.d: Actinolite blades were also seen in few specimens, which have been encountered in emeralds from other deposits too.*



*Figure 3.e: Zircon-Halo was the most striking inclusion seen in these emeralds, which were never seen before in emeralds.*

### **Few words of warning....**

Frauds and scams have always been associated with gem trade and no popular gemstone is left untouched with this, so how could these emeralds be? We, at the Gem Testing Laboratory have already encountered few instances when the depositor has directly sourced the stones from the mining areas in Jharkhand, and on testing they turned out to be synthetic emerald and / or glass rough. As per a local Jaipur trader (anonymous), pieces of green glass are first fashioned in the shape of hexagonal rough, which is then coated with fine powder of black mica mixed in glue, followed by a layer of mica chips. These worked-up pieces are then taken to the mining sites by the miners / middlemen and mixed in parcels of low-quality natural emeralds.



Figure 4: These glass samples worked-up to imitate emerald rough, are mixed in parcels of natural emerald

### To conclude...

This relatively new find of emeralds from the East Singhbhum district of the state of Jharkhand has produced a lot of interest in the local market and at very good prices. However, currently the deposits are being excavated through illegal mining, but the state government has already sent the proposal to acquire mining rights and clearances, which will help to regulate the supply of these emeralds. As per preliminary observations, these emeralds appear to be of decent colour and transparency, although in relatively smaller sizes, less than 5ct. Right now, it is too early to say, whether this deposit will contribute significantly to the emerald trade or is just another instance of 'sporadic encounter'.

## Composite Tourmaline



In the recent times, composites have gained a lot of popularity, mainly due to the innovation in the type of materials used and the range of products offered. At the Gem Testing Laboratory, Jaipur we have seen numerous examples of such unusual combinations of composites, made to create something fancy. Some of the examples include turquoise (fancy colours), opal- calcite, chalcedonies, diamond - rock crystal, malachite, serpentine - stichtite, amber - plastic, emerald - garnet - tourmaline, turquoise - rock crystal, etc. Most of these composites include chips or pieces of the mentioned gem materials held together randomly using a polymer matrix rather than the usual pattern of cementing the two substances along the girdle plane.

In this series of innovative composites, we can now add composite tourmaline, where pieces of multi-coloured tourmalines, namely, green, blue, pink, red, and brown were cemented or held together with a colourless polymer matrix. The overall appearance of this composite was of a multi-colour tourmaline. However, detection and identification of such composites usually are quite straightforward, even at a low magnification of 10x. Typical features to observe include un-oriented individual pieces or chips, with difference in the pattern of inclusions, along with areas of dull lustre within the spaces between individual pieces.

However, because of the composite nature of the specimen, it is not always easy to determine the exact nature of the gem material used. The standard gemmological testing methods give combined results for the materials used, hence, advanced spectrometers, such as Raman spectrometer, has to be used for exact determination of gem materials.

# NEW SERVICES

## AT GEM TESTING LABORATORY

Since the beginning of 2014 we, at the Gem Testing Laboratory have commenced few new services in certification, which will cover wider range of certification needs of the trade.

### Grading of Loose Diamonds

We already launched the grading of diamonds studded in jewellery in April 2013, and now beginning January 1, 2014, we have started issuing grading reports for loose diamonds of sizes up to 2 carats. Before grading process, each and every diamond is identified for its origin i.e. natural or synthetic and / or treatments performed, through advanced spectrometers and imaging systems. Two types of reports are being issued, namely 'Smart-Card' and 'A4-sized'. Although, the criteria for identification and grading remain the same, 'A4-sized' report has additional features of 'inclusion plotting' and actual 'proportion diagram' of the diamond being graded. Clients opting for A4-size reports are provided a complimentary 'smart-card' size report. Following are the certification charges (including service charge of 12.36%):



Size	Smart card Fees in Rs.		A4 size Fees in Rs.	
	Member	Non-member	Member	Non-member
Up to 0.22 ct	750	900	950	1150
0.23 to 0.29 ct	850	1000	1100	1300
0.30 to 0.49 ct	1050	1250	1300	1550
0.50 to 0.69 ct	1150	1400	1500	1800
0.70 to 0.99 ct	1250	1500	1700	2050
1.00 to 2.00 ct	1500	1800	2100	2500

### Certification of Jewellery

In addition to the diamond jewellery, we have also started to offer certification of coloured stone jewellery, where all the pieces studded in a piece of jewellery are analyzed and a combined report is issued. However, due to the limitations of testing methods when a stone is studded in jewellery, presence or absence of treatments is not mentioned, and hence the clients looking for such declaration have to opt for regular category of single stone certification. Following are the charges for jewellery certification.

*Diamond Jewellery:* Rs. 300 per carat or Rs. 500 per item, whichever is higher

*Coloured Stone Jewellery:* Rs. 60 per carat - for sizes below 6 mm

Rs. 120 per carat - for sizes above 6 mm

Or Rs. 300 per item, whichever is higher

Note: Discount of 20% will be offered to members of the Council on the above mentioned charges.

### Certification of Bead Strings of Rubies, Sapphires and Emeralds

Recently, we have also started certification of bead strings of rubies, sapphires and emeralds, which were not being done previously due to the extensive range of treatments being performed on them. However, looking at the trade requirement in the recent times, we have decided to issue reports for bead strings as well. The bead string will be considered for certification in the 10 cm blocks i.e. a minimum of 10 cm will be tested from the string submitted, while every piece falling into the specified 10 cm will be tested. Depending on the complexity of the bead string the block of 10 cm will be broken into two blocks of 5 cm each, although the minimum charges will remain for 10 cm.

Following are the certification charges:

Rs. 2500 per 10 cm for members

Rs. 3000 per 10 cm for non-members

### Quantification of Filler in Emerald

Due to the penetration of resin-filled emeralds since the beginning of 2012, the Jaipur trade has gone through major hiccups. GTL has done its best in separating the oil-filled and resin-filled emeralds, but now from January 1 2014, we have started reporting the extent of filler present in the fissures. Such reports will help the users in separating a slightly filled emerald from a heavily filled and hence the valuation. Following will be the report wordings, which have been formulated on the basis of guidelines provided by the Laboratory Manual Harmonisation Committee (LMHC):

#### Status

*No Filler*

*Minor filler*

*Moderate filler*

*Significant filler*

#### Comments

: No indications of clarity enhancement

: Indications of clarity enhancement. Minor amount of oil / resin in fractures.

: Indications of clarity enhancement. Moderate amount of oil / resin in fractures.

: Indications of clarity enhancement. Significant amount of oil / resin in fractures.

In addition, if the filler is identified as 'oil and resin mixtures', it shall now be declared as 'resin-filled'. Therefore, emeralds which have been declared before as 'oil and resin mixtures' will now get a report of 'resin' only.



## ‘रंगी हुई हड्डी’

- मूंगे का एक रोचक समरूप



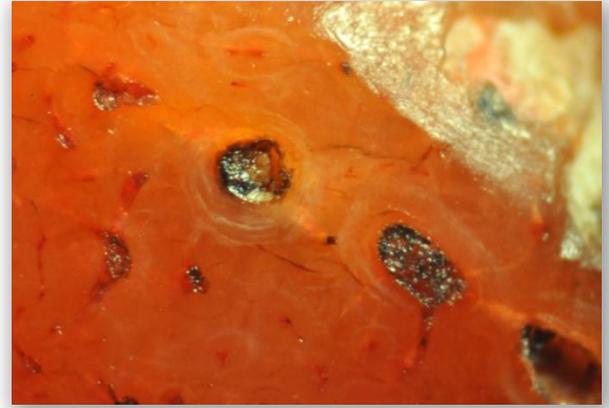
चित्र 5: रंगी हुई हड्डी

रत्न परीक्षण प्रयोगशाला, जयपुर में यूँ तो मानवकृत नित नये एवं अनोखे प्रयोग देखने को मिलते हैं किंतु कभी-कभी परीक्षण के लिए ऐसी वस्तुएँ आती हैं जिन्हें प्राकृतिक रत्न से अलग कर पाना और फिर उनका सही वर्गीकरण करना अपने आप में एक चुनौती होती है। इसी क्रम में पिछले दिनों प्रयोगशाला में एक लाल रंग का रत्न मूंगा समझकर जाँच के लिए जमा किया गया, जो परीक्षण के बाद रंगी हुई हड्डी साबित हुई।

प्रस्तुत प्रथम दृष्टया: सैम्पल मूंगा ही प्रतीत हो रहा था, किंतु जब उसका क्रमवार अध्ययन किया गया तो वह मूंगे से भिन्न प्रतीत हुआ। इस सैम्पल की रीफ्रेक्टिव इन्डेक्स (R.I.) 1.55 नापी गई, जहाँ मूंगे की 1.48-1.68 होती है, तथा स्पेसिफिक ग्रेविटी (S.G.) 2.00 निकली वहीं मूंगे की 2.50-2.70 रहती है। माइक्रोस्कोपिक जाँच में इसकी आंतरिक संरचना पूर्णतया: मूंगे से भिन्न पायी गई। मूंगे में पेड़ के तने के समान गोलाकार परतें, धारियों के रूप में दिखाई देती हैं, जो सामने से देखने पर समानान्तर और सीधी नजर आती हैं, वहीं पर प्रस्तुत सैम्पल में असमान नसों का जाल देखा गया और हरेक नस के चारों ओर सफेद छल्लों की संरचना पायी गई। हाई मैग्नीफिकेशन पर इन नसों में नारंगी लाल रंग (मूंगे का विशिष्ट रंग) का जमाव देखा गया जो कि रत्न को रंगे जाने का प्रमुख प्रमाण है। इसकी आंतरिक बनावट किसी प्राकृतिक ऑर्गेनिक पदार्थ की ओर इशारा कर रही थी। रासायनिक जाँच करने पर इसमें कैल्शियम और फॉस्फोरस पाया गया वहीं मूंगे में केवल कैल्शियम होता है। इस प्रस्तुत सैम्पल की आंतरिक संरचना तथा रासायनिक संगठन ‘हड्डी’ की ओर इशारा कर रहे थे, जिसे रमन स्पेक्ट्रा से सुनिश्चित कर लिया गया।

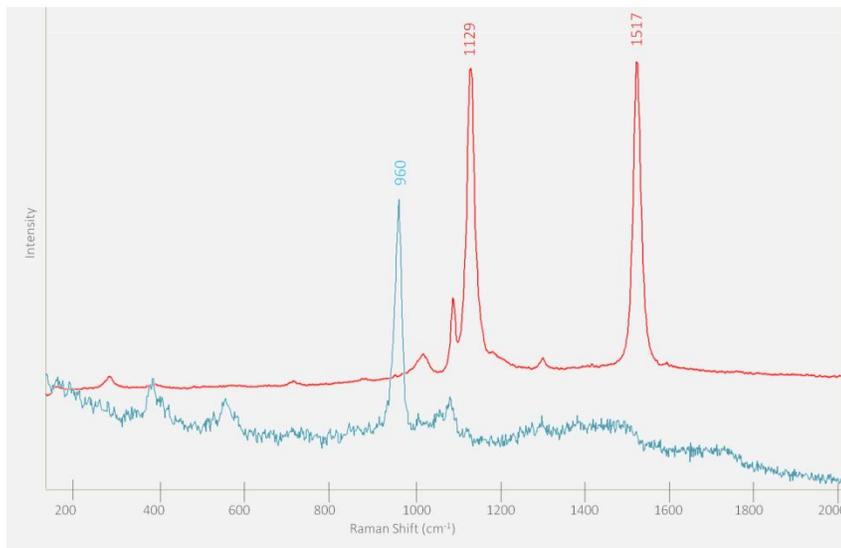


चित्र 6: मूंगे में पेड़ के तने के समान गोलाकार परतें (बाईं ओर), धारियों के रूप में दिखाई देती हैं, जो सामने से देखने पर समानान्तर और सीधी नजर आती हैं (दाईं ओर)



चित्र 7: रंगी हुई हड्डी में असमान नसों का जाल (बाईं ओर) तथा हर नस के चारों ओर सफेद छल्लों की संरचना (दाईं ओर) जिसे 'Haversian Canal System' भी कहते हैं।

पूर्ण जाँच में निष्कर्ष निकला कि यह रंगी हुई हड्डी है मूंगा नहीं। यूं तो मूंगे के और भी अनेकों समरूपी हैं, जैसे - रंगे हुए शंख, सीपियाँ, रंगे हुए सफेद मूंगे, कम्पोजिट, काँच, सिरेमिक, रंगे हुए क्वार्ट्ज एवं केल्सेडोनी आदि। किंतु रंगी हुई हड्डी विगत वर्षों में पहली बार ही देखने में आई है। लाल रंग में रंगी यह हड्डी मूंगे का काफी रोचक समरूप है।



चित्र 8: रमन स्पेक्ट्रा से पूर्णतया: सुनिश्चित कर लिया गया कि यह सैम्पल हड्डी है (नीली रेखा) जो कि मूंगे (लाल रेखा) से बिल्कुल भिन्न है।

हमें इसके उत्पादन एवं बाजार में इसकी उपलब्धता के बारे में अधिक जानकारी नहीं है। किंतु कुछ व्यापारियों के अनुसार जयपुर में इस प्रकार से हड्डी को रंग से उपचारित कर तथा तराश के प्राकृतिक मूंगे के समान बनाया जाता है। इस आशंका से इन्कार नहीं किया जा सकता कि इस प्रकार के रंगे हुए पदार्थ को मूंगे के पैकेट्स में आसानी से मिलाकर बेचा जा रहा है, जिसे अलग कर पाना आसान नहीं है। केवल रत्न परीक्षण प्रयोगशाला में ही इसकी पूर्ण जाँच संभव हो पाती है। किंतु ज्वैलर एवं व्यापारी जो केवल अपने अनुभव के आधार पर रत्नों को परखते हैं, उनके लिए ऐसे समरूपी को पहचान पाना अत्यन्त कठिन कार्य है।

सह-लेखक  
मीनू बृजेश व्यास एवं संदीप कुमार विजय

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