THE GEM & JEWELLERY EXPORT PROMOTION COUNCIL

GEM TESTING LABORATORY
Information Circular

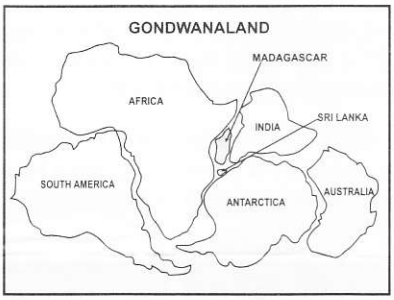
Volume 44 May 2006

Madagascar - another island with a fascinating world of gemstones!!

Up till few years back, Sri Lanka was considered as 'The island of gemstones', producing a number of fine qualities of them, but now from last seven years or so, '*Madagascar*', an island which was not very well known in the gem trade has become the major producer of some exceptional qualities of gems.

Madagascar, once was known for its vast biological diversity, but with the discovery of sapphire belt in 1998, turned into a major gem-producing region of the world. Few of the gemstones mined in Madagascar include sapphires of various colours, rubies, tourmaline (various colours including dark red, parti-coloured), garnet (mainly Tsavorite, colour change), chrysoberyl, alexandrite, topaz, andalusite, kyanite, zircon, and quartz.

The huge diversity in gemstones is the result of the breaking up of super-continent 'Gondwanaland'. Madagascar was present right in the middle of Gondwanaland, surrounded by Africa in west, India in east and Sri Lanka in south. When this super-continent started to break up, the movement of crust plates forced the magma to rise up in the middle where it solidified to form gems over millions of years.



Looking at the present day deposits, all the four regions namely, India (southern), Sri Lanka, East Africa and Madagascar are rich in gemstone deposits.

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IN THIS ISSUE....

Beryllium Diffusion in Blue Sapphires!!!

The heat treatment of corundum involving lattice diffusion (*commonly known as beryllium diffusion*) has become a major issue for the trade in the past few years. The Be-diffusion process is without question, the most broadly applicable artificial colouration of natural corundum ever achieved. Very minute concentrations of a foreign element (10 to 35 ppm of beryllium) could result in such varieties of colours and colour modifications, which are not found naturally.

Although initially only orange to orange-pink colours were seen, which were followed by yellows but now a range of blue coloured beryllium treated sapphires have been encountered on a large scale.

Various colours produced in corundum is due to the presence of minute amount of impurities like chromium, iron, titanium, and magnesium.

Pure corundum is Aluminum oxide (Al_2O_3), which is colourless. Presence of Chromium (Cr^{3+}) gives a range of pale pink to red of ruby, Iron (Fe^{3+}) produces a pale yellow, Iron (Fe^{2+}) with Titanium (Ti^{4+}) together produces blue colour. Magnesium (Mg^{2+}) along with some defects (like trapped hole pairs) also gives yellow colour (Refer January 2006 Lab Information Circular for more information).

Combination of colouring elements produces wider range of colours as in case of purple sapphires, which is produced by a combination of Cr^{3+} (red) and Fe^{2+}&Ti^{4+} (blue). Similarly a wide range of colours is produced depending upon the types, state and amount of impurities.

Very minute amounts of Fe^{2+} and Ti^{4+} in combination are required to produce the blue colour of sapphires. Each Ti^{4+} interacts with one Fe^{2+} atom giving the blue colour.

The Process...

Corundum from various sources like Thailand, Australia etc, contain a very high amount of Iron (Fe) which along with Titanium gives a very dark blue colour (more the amount and interaction between these two impurities, darker the colour). This intense colour is not desirable as it gives blackish over-saturated blue colour that looks opaque. Such stones are treated with Beryllium at temperatures of around 1800°C for 25-35 hours in oxidizing conditions (more oxygen in the atmosphere).

Beryllium interacts with other elements in the lattice of corundum thus affecting the colour. In the case of blue sapphires, the colour becomes less saturated. A slight yellow tinge may appear due to excess beryllium. This yellow tinge may be removed/reduced by a second step process.

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Continued page 1

The major gem produced in Madagascar is corundum, which gave recognition to this fourth largest island of the world as one of the major gem-producing nation.

Corundum of extremely fine quality was discovered in 1998 in Ilakaka region in the southern part of the island. The mining area is well spread over 4000 sq. km., which includes various deposits at Ilakaka, Sakaraha, Manambo, Voavoa, Fotiyola, Andranolava and Murarano.

The majority of corundum produced here is pink, but some other colours including red, blue, violet, colourless, yellow, stars, fancy colours and colour changing are also found.

The discovery of pink sapphires from this region in huge quantities initiated the gem treaters to modify the colour, which resulted in controversial pink-orange 'padparadscha' types, because of the mixture of chrysoberyls while heating.

Another most active and populated ruby and sapphire mining area currently after Ilakaka is Andilamena, which produces the starting material for lead glass-filled rubies.

Other important Corundum localities in Madagascar include Ambondromifehy, Andranondambo, Tiramene, Manombe, in north, Diego Suarez (at Ambondromifehy) and Nosy Be, Vatomandry (fine quality rubies) and Ambohimandroso.

Other than corundum, some fine qualities of Emeralds are also found including stars with intense body colour at Mananjary.

Garnet is another important gem found including high quality of Tsavorite, Spessartine, Malaya and Colour changing varieties (Pyrope- Spessartine).

Gem Diversity...

Stone Name	Locations
· Apatite	Milanoa, Itrongay
· Beryl (Aquamarine/ Others)	Ankazobe, Betafo, Berere, Amboasary, Ambositra, Andapa, Vondrozo, Tolanaro, etc
· Beryl **(Emerald)**	Ianapara, Mananjary
· Chrysoberyl (including alexandrite)	Ankazobe, Ambositra, Ilakaka, Andranolava, Ambodibakoly
· **Corundum** (Ruby/ Sapphire)	Gogogogo, Ejeda, Antanifotsy, Ambilobe, Ilakaka, Andranondambo
· Feldspar	Betafo, Ambositra, Ambatondrazaka, Kandreho, Itrongay, Faratsiho, etc
· **Garnet**	Betafo, Sahatany Valley, Ilakaka Gogogogo, Ambositra, Tolanaro, Maevatanana, Mahajanga, Maralambo, Ampanihy.
· Iolite	Sahatany Valley, Toliara
· Pezzottaite	Ambatovita, Mandrosonoro
· Quartz (different varieties)	Betafo, Sahatany Valley, Ambilobe Tsarantanana, Ambovombe, Ambositra, Andapa, Vondrozo, Mahasolo, Vatomandary, etc
· Spodumene	Betafo, Sahatany Valley, Antsirabe, Ilakaka, Andranolava
· Sphene	Daraina, Milanoa
· Spinel	Ilakaka, Sakaraha, Andranolava, Ranohira
· **Tourmaline**	Betafo, Sahatany Valley, Ilakaka, Antsirabe, Ambisitra, Vondrozo, Ambatondrazaka, Ranohira, Mananara, etc
· Topaz	Ambositra, Ilakaka, Ranohira, Andilamena, Faratsiho, Mahabe, Ambatolampy, Andriamena,
· Zircon	Antanifotsy, Amboasary, Ilakaka, Sakaraha, Ranohira, Betroka, Fianarantsoa

Map of Madagascar showing major gem producing areas

Discovery of huge deposits of some major gemstones like corundum has opened the doors for Madagascar to enter the gem world. Prior to this the basic profession was farming, and now more and more farmers are turning into gem miners.

Madagascar was considered as one of the poorest nation on the earth but the discovery of gems has given a breakthrough in its economy. In the initial stages, unconventional mining methods were employed that resulted in smuggling of gems out of the nation, therefore no value addition was being made to the nation's economy.

But now government has taken steps to exploit these deposits by mechanical and organized mining techniques. Moreover, the government is trying to reduce smuggling, investments are being done to establish administrative offices near the mines, setting up certification laboratory and cutting centers for the dealers, etc.

Since India, Sri Lanka and East Africa were its nearest neighbors, which are one of the richest gem localities in the world and shares a similar geology, therefore Madagascar also carry those reserves of gems, which will be exploited in the coming years.

Madagascar has now become the most important hunting grounds in the gem trade and is going to be a major supplier of gemstones in the near future for a very long period of time because of the new findings.

Continued from page 1....

Modification of colour...

Titanium can interact with iron (giving blue) or with magnesium (giving no colour). It is the excess of Iron and Titanium that interacts to give the dark blue colour. Beryllium behaves like Magnesium, combines with Titanium to give no colour.

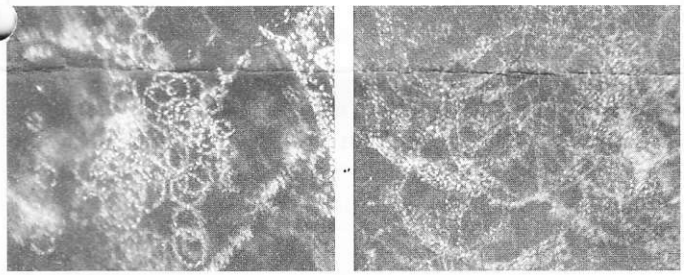
Corundum containing high iron percentage (like from Thailand or Australia), the amount of Titanium and Iron interaction is very high giving a dark blue colour, but when Beryllium is diffused inside the lattice of the stone, Titanium will prefer interacting with the atoms of Beryllium rather than iron due to some defined rules of chemistry.

This means that more the Beryllium, more is the interaction between Titanium and beryllium and lesser between iron and titanium thereby reducing the overall colour saturation. The overall body colour depends on titanium and beryllium ratio as: *Case 1*: Ti > Be; resultant colour is blue with lesser saturation than before; *Case 2*: if Ti = Be; the interaction does not give any colour; *Case 3*: if Ti < Be; yellow orange colour is seen. Therefore very minute percentage of beryllium is required to modify colour of such sapphires.

Some times during the treatment, excess of beryllium may enter the lattice resulting in a tinge of yellow/orange colour along with primary blue colour. The yellow tinge may be removed by subjecting the stones to heat treatment again in reducing atmosphere (no oxygen in the atmosphere) conditions, improving the overall appearance of the stone.

Identification...

This treatment cannot be detected in most cases and requires advanced testing like LIBS, SIMS or LA-ICP-MS. When present a colourless or yellow/ orange colour rim (due to excess beryllium) is observed immersing the stone in methylene iodide and viewed under diffused illumination. In addition, some white cloudy circular rings associated with silk inclusions may be seen, which have been observed so far only in blue sapphires treated with beryllium.



The range of colours being modified / altered is quite high, therefore all rubies and sapphires showing indications of high temperature heat treatment should be suspected for Beryllium diffusion as well.

In such cases, GTL certifies such stones as heat treated with a comment on possibility of beryllium diffusion.

AGTA is certifying such stones as:
Enhancement: "Indications of Heating"
Comments: "Further advanced analysis is required to determine whether or not a foreign element has been introduced".

GTL...Annual Award Function 2006...

Gem Testing Laboratory, Jaipur celebrated its annual award function on 15th April 2006, at Mohanlal Sukhadia Hall, Rajasthan Chamber Bhawan at 4:00 P.M.

The function was held to present certificates to the candidates who have successfully passed the gemology courses conducted at Gem Testing Laboratory, Jaipur during the year 2005-06. The courses include Diploma in Gem Identification and Masters' Diploma in Gem Identification.

The Chief Guest for the ceremony was Shri Kuldeep Ranka, Managing Director RIICO Ltd.

Other distinguished guests from the local Gem and Jewellery industry were present; some of them were Shri Kishandas Maheshwari (Convener, GJEPC, Jaipur Region), Shri Vijay Kumar Chordia (Convener, Technical and Education Committee, Jaipur), Shri Mehul Durlabji (Co-Convener, GTL), Shri Rajiv Jain (Convener, Colour Stone Panel, GJEPC), etc.

On the occasion, Shri Vijay Kumar Chordia, Convener, GTL gave a brief report on the activities conducted at GTL during the year 2005-06. On the occasion he also announced a new course as "Crash Course in Gem Identification" for six weeks, covering 23 major gemstone species; first batch commenced from 24th of April 2006.

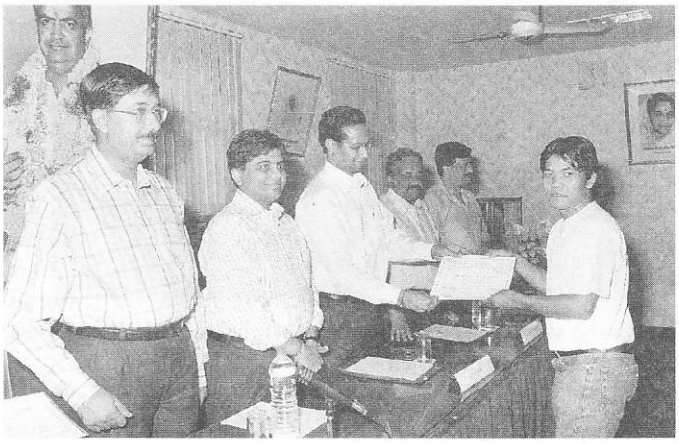
Chief Guest, Shri Kuldeep Ranka, congratulated the passed out students and emphasized on the need of a Gem Testing Laboratory in the industry, which helps in eradicating unemployment and giving a confidence to the traders. He stated the importance of Jaipur jewellery trade in upgrading not only the Indian economy but also the culture and building Jaipur by way of upgrading the skills of the manpower thereby leading to the prosperity. He also gave students the principles to succeed in life - *knowledge, skill and values*.

The two trade awards were given to the following candidates:

1. Durlabhji Education Trust Award for Best Student (Overall) of the Year 2005-06 - Vipin Aggarwal.

2. Bhuramal Rajmal Surana Award for Best Student in Practical of the Year 2005- 06- Arpit Jain

The ceremony was concluded with a vote of thanks by Shri Mehul Durlabhji, Co-Convener, GTL.



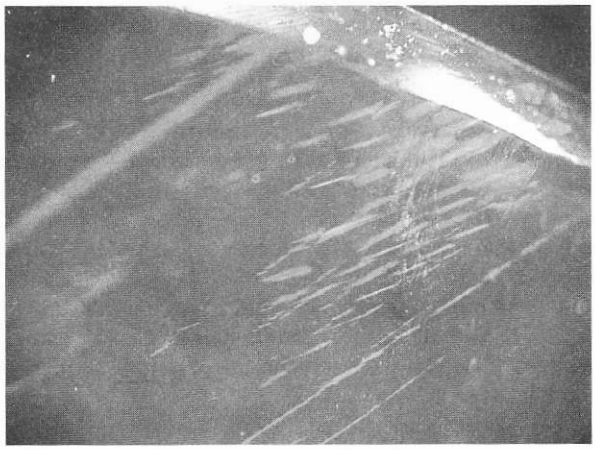
Chief Guest with other Trade members on the dias giving away Certificates to the passed out candidates.

Red Feldspar *Labradorite or Andesine?*

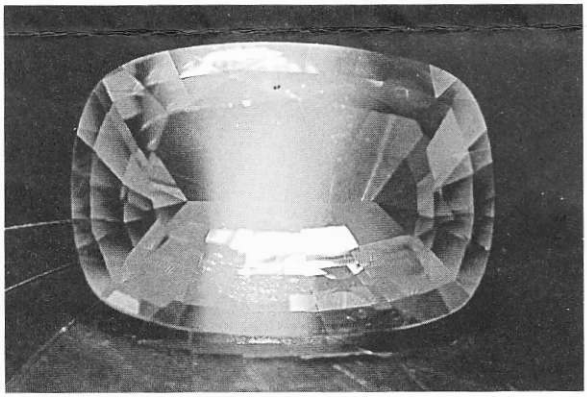
Recently at GTL, we analysed a red coloured stone said to be Red Labradorite. This was certainly unusual for us since it was the first time we encountered such strange colour of a very common mineral - feldspar.

The stone was almost transparent, cushion mixed weighing 3.88 carats, red colour with slight orange secondary shade coming through. Refractive index was varying between 1.560 and 1.570, with maximum birefringence of 0.010 and optic character/ sign determined was biaxial positive. Specific gravity measured was at 2.68.

Under visible range spectroscope the stone exhibited a strong band at around 570 nm and a cut off till 450 nm, while magnifying, stone displayed 2 directions of whitish / cloudy planes following two cleavage directions of feldspar. Out of the two directions, one direction was clearly visible while the second was much weaker.



When the stone was observed using strong fiber optic light it appeared translucent with a haze resulting from minute particles as seen in the picture below.



Recently, similar stones have been originated from Oregon in USA and Congo in Africa.

The properties obtained for this stone were within the range for red labradorite and andesine.

Feldspar is basically divided into two broad categories on the basis of composition as Potassium feldspar (include Orthoclase and Microcline) and Plagioclase feldspar (is an isomorphous series between Albite- Na and Anorthite - Ca).

Plagioclase series has a wide variety of species depending on the percentage of sodium and calcium. Various members of the series according to increasing percentage of calcium are Albite, Oligoclase (sunstone), Andesine, Labradorite, Bytownite and Anorthite.

Species	Na %	Ca %
Albite	100 to 90	0 to 10
Oligoclase	90 to 70	10 to 30
Andesine	70 to 50	30 to 50
Labradorite	50 to 30	50 to 70
Bytownite	30 to 10	70 to 90
Anorthite	10 to 0	90 to 100

With the increasing percentage of calcium, the RI and SG values increase along with there is a change in optic signs as in case of andesine and Labradorite. Following are the values obtained from stones found in Congo and Oregon:

	RI	SG
Andesine	Congo 1.551 – 1.560 0.009; B -	2.67
Labradorite	Congo 1.553 – 1.562 0.009; B+ Oregon 1.560 – 1.570 0.010; B+	2.68 to 2.70 2.70 to 2.72

When we compared the values obtained for red feldspar, it was concluded as Labradorite, but we could not determine the origin since the readings overlapped the values reported for Labradorite from Congo as well as Oregon.

Since the feldspar group has number of different species, all related to each other and the basis of classification depends on the percentage of elements present. The gemological properties help to identify the correct species only up to a certain limit, but in case of borderline mixtures, correct classification can be made only by elemental analyses.

A distinct classification of these stones is utmost necessary for a lab but does it really matter to the trade? Now it is only the time who will decide, whether these stones to be called as Labradorite, andesine or simply red feldspar.

Some Interesting Stones at GTL....

Two Star Emeralds

Recently, at Gem Testing Laboratory, Jaipur two specimens of fine bright green emeralds with asterism weighing 11.37 and 5.40 carats were tested and certified. Both the specimens displayed a six- rayed star with one ray along the length of the stone stronger as compared to the other two.

The gemological properties were constant with the values reported for natural emerald; spot RI was measured at around 1.59 and specific gravity was recorded at 2.73 measured by hydrostatic weighing, both specimens exhibited strong chromium spectrum characteristic for emeralds.

The cause of asterism in these emeralds was fine inclusions in planes (perpendicular to 'c' axis) and zones (parallel to prism faces). The arrangement of these inclusions was similar to as found in star corundum. At the higher magnification, these inclusions appeared discs / platelets that were hexagonal and triangular in shape; some of these inclusions were elongated as well, similar to knife shaped rutile silk in corundum.

When these inclusions were observed in reflected light they appeared iridescent and in transmitted illumination, appeared gray, varying in transparency from translucent to opaque.

The major concentration of these inclusions was in the centre, which resulted in a strong bright reflection at the centre of the stones when viewed in reflected light.

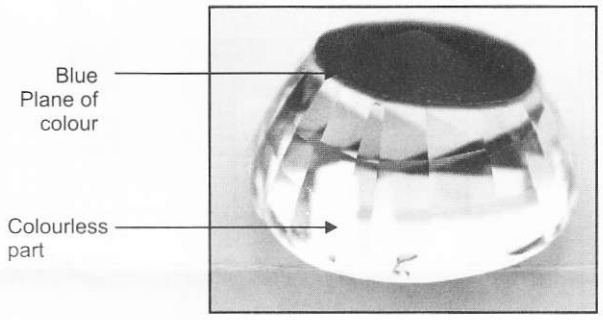
The source locality of these star emeralds were not known but have been reported in the literature from Brazil (Minas Gerais and Santa Terezinha) and Madagascar (Mananjary area). Though star emeralds are in itself unusual, but the colour shade of these emeralds make them more rare.

Blue Sapphire with Unusual Colour Zoning

A blue stone, weighing11.29 carats, a modified oval facetted (a flat face replaced the culet) with unusual colour zoning was encountered. Refractive index was measured at 1.760 1.770 and hydrostatic S.G. at 3.98, these properties confirmed the material as corundum.

When the stone was viewed table up, it appeared uniformly blue. From the side, it appeared almost colourless with a strong blue colour in a plane at the end of pavilion. Under the short-wave ultra violet light, the blue plane/ zone displayed a strong chalky greenish blue fluorescence, while inert under long-wave ultra violet. Visible spectrum had moderate absorption band at 450 nm and a weak band at 470 nm. The optic axis of the stone was running across the pavilion parallel to the colour plane / zone

With magnification, some cloudy cotton like dotted inclusions were observed around a sugary crystal, along with some cloudy whitish healed fingerprints. These inclusions are associated with the high temperature heat treatment of corundum. In addition, when the stone was immersed in methylene iodide and observed using diffused illumination, some parallel and straight colour zones were noticed across the plane containing blue colour. Moreover, there were some blue zones present in the pavilion part, weaker in intensity parallel to the flat plane-containing colour.



The absence of colour concentrations along the facet edges or the girdle edge along with the thickness and/ or pattern of colour zones only on one side of the sample eliminated the possibility of diffusion treatment.

These observations indicated that the stone was cut from a strongly colour- zoned sapphire with colour restricting parallel to the prism faces, which was determined by the direction of optic axis; the colour plane and optic axis were running parallel to each other. This type of zoning has been observed in sapphires from Songea and Sri Lanka as well as in some greenish blue sapphires from India

Tugtupite

Recently we got a chance to analyze few samples of this rare mineral courtesy Mrs. Shyamala Fernades. The specimens observed ranged in colour from white to dark pink with transparency varied from semi transparent to opaque. Vague refractive index measured was around 1.490 to 1.500 with a weak birefringence blink, while specific gravity was measured at around 2.35.

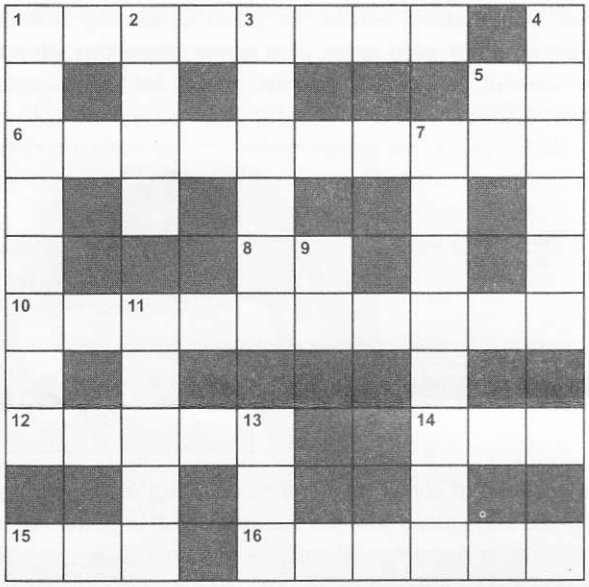
The most striking feature observed was its characteristic fluorescence in ultraviolet light. Tugtupite exhibits a strong orange under long wave while reddish under short wave. Under magnification, these samples exhibited cloudy patches in zones forming tetragonal pattern; other inclusions observed were black needles and liquid fingerprints with high reflection as seen in tourmalines.

Tugtupite was discovered in 1960 in Tugtup, Greenland from where it has derived its name. Other source for this rare mineral is Russia. Today, tugtupite is one of the rare minerals, and is very difficult to find one in its crystal form but is often encountered as massive with mottling.

This mineral is not commonly used as a gem but the collectors are always interested because of its intense reaction under ultraviolet light.

GTLians' Corner.....

Cross word



HINTS

Across

1. a colourless variety of the stone known for its wide range of colours of rainbow (8)
5. symbol for an element in basic composition of fluorite (2)
6. bending up of light ray when it changes its medium (10)
8. chemical symbol for an element helpful in separation of natural and synthetic ruby (2)
10. the process of filling a substance in surface reaching cracks for enhancing the clarity (verb) (10)
12. an opaque gem, consisting a mixture of chrysocolla and malachite (5)
14. unit used to measure the intensity of light (3)
15. acronym for a software commonly used for designing jewellery (3)
16. another name for emerald cut (6)

DOWN

1. substance used for grinding, cutting, and polishing of stones (8)
2. the estimation of specific gravity in hands (4)
3. river in Africa rich in diamonds, shares its name with a fruit (6)
4. another term for the ceramic pedestal used in synthesis by verneuil technique (6)
5. symbol for transition element responsible for blue colour in glass (2)
7. type of cut in which carving is done below the girdle edge (8)
9. chemical symbol of a precious metal used for coating (Red Aura) stones (2)
11. term used for neutron treated diamonds (5)
13. number of pleochroic colours in Benitoite (3)

ANSWERS

Across: 1. Achroite; 5. Ca; 6. Refraction; 8. Ga; 10. Impregnate; 12. Eilat; 14. Lux; 15. CAD; 16. Oblong

Down: 1. Abrasive; 2. Heft; 3. Orange; 4. Candle; 5. Co; 7. Intaglio; 9. Ag; 11. Piled; 13. Two

Puzzle

Find out all the possible words (Horizontal and Vertical) related to gem and jewellery industry from the box. Hint: Read the complete information circular!!

S	I	M	S	S	A	M	U	T	I	T
B	M	A	D	A	G	A	S	C	A	R
E	A	C	E	K	E	N	A	O	L	I
I	L	A	K	A	K	A	L	N	B	N
N	I	L	I	R	O	N	E	G	I	G
D	B	C	P	A	G	J	A	O	T	S
I	S	I	P	H	E	A	D	I	E	A
A	R	U	M	A	M	R	E	D	A	G
R	I	M	A	L	A	Y	A	U	R	A
P	E	Z	Z	O	T	T	A	I	T	E

Answers

SIMS, Madagascar, Ilakaka, Pezzottaite, India, LIBS, Iron, Sakaraha, Mananjary, Congo, Albite, Rings, Malaya, Aura, Calcium, Rim, Mali, Red, Lead, PPM, USA, Be, Ag, Ti, Gem

Jumble

Arrange the following jumbled letters to form varieties of garnet.

1. lamyaa = _ _ _ _ _ _

2. inameland = _ _ _ _ _ _ _ _ _

3. otilepazot = _ _ _ _ _ _ _ _ _ _

4. tomdidane = _ _ _ _ _ _ _ _ _ _

5. ed it a n r g = _ _ _ _ _ _ _ _

Now arrange the highlighted letters to form a word, which is the name of a commonly used treatment and sounds like, someone is going to be no more!!

Answers

1. Malaya; 2. Almandine; 3. Topazolite; 4. Demantoid; 5. Grandite

The name of the treatment is DYEING!

GTL...Results...

Following candidates have been declared successful in the Gem Identification Courses.

Diploma in Gem Identification- Batch no. 36

1. Vipin Aggrawal - 1st Overall
2. Ryoko Nohmura - 1st Practical
3. Mizuho Mase
4. Nobuko Kono
5. Chhatraveer Singh
6. Nidhi Agarwal
7. Gaurav Gupta
8. Manoj Pareek

Certificate Course in Gem Identification

1. S. Prathick Kumar
2. Deepa Joseph
3. Lechaix Philippe Marie

Diploma in Gemmology from Gem-A, UK (FGA)

Two candidates appeared for January diploma examinations conducted by Gem-A, UK. Both have been declared successful.

1. D. Mohit Challani (Passed with Merit)
2. Ashka Rana

CONGRATULATIONS TO ALL OUR STUDENTS AND WE WISH THEM ALL THE VERY BEST IN ALL THEIR FUTURE ENDEAVOURS. WE HOPE THEY WILL MAKE A VALUABLE CONTRIBUTION TO THE GEM & JEWELLERY TRADE

HAVE FUN...

A woman's husband dies. He had $30,000 to his name.

After everything is done at the funeral and cemetery, she tells her closest friend that there is none of the $30,000 left.

The friend says, "How can that be?"

The widow says, "Well, the funeral cost me $6,500. And of course I made a donation to the church. That was $500, and I spent another $500 for food and drinks, you know...the rest went for the memorial stone."

The friend says, "$22,500 for the memorial stone? My God, how big is it?"

The widow says, "Three carats"!!!!

A look at the activities...

GTL announces a new course. Crash Course in Gem Identification

The concept of the course is to give a basic idea on major gemstones in the market today. The course covers the topics more than Navratna course (includes only major nine gems)) and lesser than Certificate course (covers about 45 species).

Following are the details:

Duration : Six weeks (30 sessions)

Timings : 3.00 to 5.00 pm

Syllabus :

Introduction : Basic qualities (beauty, rarity, durability), classification of gem materials, weights and measures.

Physical Characteristics : Hardness, Cleavage, Fracture, Specific Gravity, and Estimation of Heft.

Crystallography : Nature of Crystal, Elements of Symmetry, Crystal Systems, Forms, Habits, Twinning, Surface marking, Identification of Rough.

Optical Characteristics : Transparency, Reflection, Refraction, Polarisation, Refractive Index and its measurement, Colour and its causes, Pleochroism, Dispersion, Absorption Spectroscopy, Luminescence, Phenomenal effects if any-Chatoyancy, Asterism, Sheen, etc.

Instruments Used In Identification : 10X lens, Microscope, Polariscope, Dichroscope, Refractometer, Ultra Violet Light, Specific Gravity by Hydrostatic method and Liquid Immersion, Chelsea Colour Filter, etc.

Methods of Synthesis : Identification, techniques, manufacturers and trade names.

Enhancement : Methods And Their Identification

Gemstone species : *RI Range 1.4- 1.5*: Lapis Lazuli, Opal, Fluorite; *RI Range 1.5- 1.6*: Iolite, Feldspar, Beryl (Emerald, Aquamarine), Quartz (Amethyst, Citrine, Smoky, Rose, etc); *RI Range 1.6- 1.7*: Topaz, Tourmaline, Apatite, Diopside, Peridot, Zoisite (Tanzanite); *RI Range 1.7- 1.8*: Garnets, Kyanite, Chrysoberyl, Corundum (Ruby & Sapphire), Spinel; *Over Range*: Diamond, Zircon, Sphene; *Organics*: Coral, Pearl

Simplified System Of Identification : The specified gemstone from its simulants - both rough and cut stones.

Types of cuts used, the importance of orientation, assortment and valuation.

Worldwide *occurrences*

Fees : Total: Rs. 13,000

Rs. 10,000 + Rs. 3,000 (Caution Deposit)

What's running these days: - Trend.... PARAIBA TOURMALINE

In the last issue of lab information circular we gave an introduction to these electric 'neon' blue to green tourmalines from Paraiba. Now suddenly, it has become one of the most desirable gems throughout the world. This is the hottest trend!

Since the initial discovery of this beautiful 'neon' or 'electric' blue to green tourmaline in 'Paraiba' in Brazil, production has been sporadic and has not kept up with the strong market demand, but recent discoveries in Nigeria and Mozambique have regulated the supply of these tourmalines to the world market and therefore the demand of these stones have also risen.

Tourmaline is a very well known stone in the gem industry, which is found in all the colours of rainbow due to its complex chemistry and number of chemical impurities such as iron, vanadium, manganese, chromium and copper. The Paraiba tourmalines are coloured by copper, which was never found before the discovery of this deposit. In addition, it often also contains the traces of manganese; the combination of these two elements- copper and manganese give rise to a wide range of beautiful and fascinating colours in Paraiba tourmalines: emerald green, turquoise to sky blue, sapphire blue, indigo blue, dark purple to red; such colour are commonly associated with 'Paraiba Tourmalines'.

But recently discovered tourmaline deposits in Nigeria and Mozambique also contain copper as an impurity giving the colour shades similar to as found in Paraiba. The colour shades and their cause is similar in tourmalines from Paraiba and Nigeria or Mozambique, therefore using the classification- 'Paraiba Tourmaline' becomes incorrect. To overcome this problem, Japan Jewellery Association / Association of Gemmological Laboratories have suggested to identify the stone as "Tourmaline" with a comment stating, "This type of tourmaline is commonly known in the trade as Paraiba Tourmaline"; also the term "Paraiba" is not a variety name, therefore it cannot be used in a routine Gem Identification Report.

These tourmalines are also modified by applying heat in a simple electric furnace without any atmosphere controls at the temperature ranging from 480° to 620°C. In general, colour changes can be achieved include: purplish red to 'emerald' green; purple to light purple; greenish blue to 'neon turquoise blue'; violet violetish blue to light blue neon blue; dark blue to neon blue.

The Paraiba tourmaline is also imitated by a number of gemstones such as apatite, beryl, glass, synthetic spinel, natural zircon, etc. A quick separation can be made on the basis of properties given in the following table.

Stone	Optic Character	RI	SG	Inclusions / Other Features
Tourmaline	DR, Uniaxial negative	1.624 - 1.644 DR 0.020	3.06- 3.12	Trichites, liquid inclusions, copper flakes, etc; 'C' axis colour absorption.
Apatite	DR, Uniaxial negative	1.640 - 1.645 DR 0.005	3.15 - 3.23	Black canals, cleavage cracks, fingerprints
Beryl	DR, Uniaxial negative	1.570 - 1.590 DR 0.008	2.68 - 2.75	Rain inclusion, phase, liquid films, crystals of various minerals, etc.
Synthetic Spinel	ADR	1.730	3.61	Gas Bubbles Bands at 540, 580, 630,nm UV Fluorescence: Red in LW, Chalky in SW
Glass	SR	1.45 - 1.60 SR	2.40 - 2.80	Gas Bubbles, Swirls, UV Fluorescence: Chalky in SW

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