Processing of Gem Minerals

by

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Abstract : The processing of Gem Minerals includes identification, selection for variety and grading for quality, size and use etc. It also includes identification of rare stones, identification and selection of stones which need to be treated (heat or otherwise) prior to cuttiug, polishing and other forms of treatment. The author also stresses the following :- The various stages of cutting and polishing, carving of ornamental items, making abrasives, grading and grouping of cut and polished stones for marketing to the traders, related industries or to the ultimate user.

Gem minerals are any minerals belonging to the family of gems whether they are gem quality or not. Gem minerals like any other mineral are processed for the purpose of enchancing the value.

The processing gem minerals commences at the gem pit itself, from the point of completion of washing and picking the gems from the Nambuwa or the gravel remaining in the washing pan when the washing is completed. Looking at the nambuwa is a specialist's job and one would be surprised to see how quickly trained eyes could spot a gem stone in the nambuwa.

A trained eye is needed for the purpose of looking at the nambuwa because it is very rarely the nambuwa is inspected twice. If you miss a gem stone at the first inspection of nambuwa you may have lost it forever.

Once, identifying the gem minerals from the ordinary gravel in the nambuwa is completed, it is very important to identify the varieties without making mistakes. A simple example is one should be able to identify a Ruby from a Garnet or a Blue Sapphire from a Blue Spinel or an Alexandrite from Green Tourmaline or a Chrysoberyl. If this is not done correctly it would mean that one could sell a Ruby worth half a million for Rs. 50/- mistaking it to be a Granet or a Red Spinel. Same thing could happen to a Blue Sapphire or to an Alexandrite unless a proper identification and selection for variety is done. Therefore this is a very important area of processing of gem minerals.

Once identification and selection for varieties is done, it is important to do a selection and grading within an individual variety of stones for quality, size, use, etc. This aspect is very important, as the difference in value of two stones of identical size, of identical clarity, identical weight could vary tremendously due

to variation in colour. Similarly two stones which have identical colour, identical weight and size, but a fair difference in the lustre, the price variation could be anything between one is to 100 or more. Consider the case of two Blue Sapphires where the quality, colour, lustre, clarity are identical but they differ in size. The first one being two carats and the other being ten carats. The difference in size here is one is to five but the difference in price could be one is to 100 or more. Therefore the selection and grading within an individual variety is a very important aspect of processing of gem minerals.

In certain varieties of gem stones invaluable rare specimens occur. A good example is the Taffitte which occurs within a spinel family. At the early stages of detection of this rare stone the value difference was more than one is to 100 compared with a Spinel.

Identifying stones which needs to be treated prior to cutting and polishing is equally important as the treatment of stones either by heat or otherwise enhances the value in leaps and bounds. The heat and other forms of treatment is so much talked about today, I wouldn't be surprised if the participants of this symposium expect me to speak mostly or only on heat and other forms of treatment when the title of my paper is "Processing of Gem Minerals". However, trying not to be unfair by the participants of this symposium I have decided to devote a fair amount of the time allocated for my lecture, to speak on heat treatment of gem stones, which is intended to enhance the value of a stone by increasing the colour, lustre, clarity or bringing in a completely new colour into the stone.

Heat treatment or all forms of treatments is being increasingly becoming acceptable in the world of gem stones. Long before the latest hue and cry about the heat treatment of milky or silky or patchy corrumdums 90% of the Sri Lankan Rubies were heat treated to enhance colour, lustre, clarity, etc.

The most common stones subjected to heat treatment is the sapphire or the corrumdum family. I have no doubt most of you are aware that heat treatment of milky or silky sapphires was "introduced" to Sri Lanka by the Thai nationals who alone were the masters of this secret. This know-how was protected within the family organization or teacher to student form of organization. These Thai nationals started purchasing in mid 1970's the hitherto valueless milky, silky and oher forms of corrumdum, rousing curiosity in the minds of those locals who were more alert to the trends of the gem trade. However while these stones were purchased at an unprecedently high value what they did with these stones was a closely guarded secret till late 70's. It is said in the gem cirlces that the secret was so closely guarded, the Thai nationals even stooped to the level of purchasing the wrong quality gem stones, at very high prices, while purchasing the good quality stones at a give away price, so that the locals would be flabergasted as to the quality that could be treated and that could not be treated. However, the scientific aspect of heat treatment is nothing new to our gemmologists.

Blue Sapphires get their blue colour from the colouring element called Titanium. The colour and the lustre in a blue sapphire largely depend on the titanium absorbtion. If the titanium is totally absorbed into the stone, it will produce a beautiful blue sapphire with beautiful lustre. If it is partially absorbed it would give a partial blue colour into the stone. If it is unabsorbed it would give the blue sapphire a dull whitish or brownish colour which makes it popularly and primarily known as geuda of young milky, milky or silky effect.

What does happen when a stone is heated? As you are aware every stone is of some kind of atomic structure. The atomic structure of the blue sapphire when heated starts to expand spacing out the atoms. At 1650°C the titanium starts melting and once the titanium is melted, the titanium starts spreading or migrating among the atoms that have already expanded its spacing due to heat. This is the scientific analysis of the reaction that takes place inside the stone when subjected to heat treatment.

If one goes to any gemmologist in this country or abroad, I am sure that the theory of heat treatment could be learnt. One could wonder why everyone cannot do heat treatment, when scientific explanation is as simple as what I have explained in the above paragraphs. Heat treatment is not as simple as the scientific theory that has just been explained. The most important aspect of heat treatment, is the *selection* of stones and pre determining the degree of heat, the period of heat and the intensity of heat required to successfully heat treat different varieties.

In the corrumdum family there are a number of types of stones which are subjected to heat treatment to make beautiful blue sapphires. The most popular is the geuda which has become a common name for a number of different types of corrumdum stones. The generalised term geuda includes the milky, silky, ottu, ural ottu, male ottu dot stones etc. For each variety, the degree of heat, the period of heat, and the intensity of heat needed is different. What degree of intensity of heat and what duration of heat needed for each type of stone can only be known by trial and error method. This can be done only by engaging in heat treatment for a substantial period of time, with substantial capital and of course with very high risk.

It is amazing to see that some of the stones that do not react to the 1st occasion of heat treatment reacting in the 2nd occasion or at a later occasion may be the 10th or the 20th time. I had the rare experience of heat treating one stone 5 times over and over again, unsuccessfully trying to get rid of a deep brownish tint in the stone. The stone turned to a beautiful blue sapphire after the 2nd occasion, but the brownish tint refused to leave the stone until the flame was applied right on to the stone for a period of about 4 hours. It is in fact a high risk area of the gem business, but without engaging in it one would never learn.

Once you have selected your stones for heat tratment one has to prepare those stones by sawing and grinding the stones wherever necessary to get rid of any flaws, air bubbles and other undesirable inclusions in the stones, without which process the stones could crack at the high temperature they are subjected to.

There are other forms of treatment of gem stones which some of you are aware of. The radiation method of treatment is another form popularly used mostly in other countries and also in Sri Lanka. I have no doubt everyone of you have read about how some employees of the Cancer Institute used their Cobalt machine for radiation treatment of gem stones.

It is said that stones subjected to radiation treatment, will fade in colour over a period of time, but from my experience and from scientific information that is available, the heat treated stones do not fade in colour or lustre in the natural environment.

Cutting and polishing of gem stones is another very important step in processing of gem stones. The cutting and polishing of stones becomes very critical for those stones called precious stones.

In cutting and polishing the first step is called "preforming" which has to be done specially in stones which has one optic axis that gives the best colour and best lustre. Take the case of corrundum which has one optic axis which gives the best colour and the best lustre. In gemming language this optic axis is called Vakkuwa. Unless one knows how to get the best colour, best lustre, best face and the best shape of the stone one could make very expensive mistakes. An expert examining a stone, and what the best shape is to preserve colour and weight.

The marketabillty of the Gem stones is very low unless properly cut. A conscious buyer would either not buy or would buy expecting to re-cut a badly cut stone which would ultimately mean, that the buyer would pay at least 20% less for the stone, which constitutes the loss of weight expected in recutting the stone In today's gem market the cutting has become very critical and no foreign buyer will sympathize with a wrong cut made to preserve the weight. However it is equally important to preserve weights when cutting and polishing the stones, but it cannot be at the cost of the shape, colour or lustre of the stones.

I had the rare opportunity of handling rough Blue-Sapphires of more than 300 carats belonging to a Sri Lankan Gem Merchant. Owner of these stones having consulted a number of expert cutters in the country was not satisfied with the opinion expressed by them regarding the cut and expected weight which was around 80 carats. Therefore, he consulted a number of Amercian experts. One American expert assured a cut and polished stone of more than 100 carats, which he saw was possible if the stone was given the "old cushion" cut instead of the round brilliant cut. Ultimate result was a top quality Blue Sapphire of 101 carats, in the "old cushion" cut.

The additional 21 cts. preserved by the "old cushion" cut enhanced the value of the stone by more than 100% although the weight preserve was about 25% compared to the original assessments of the local experts. It is, therefore, evident without any doubt, that selecting the proper cut for gem stones is a very important aspect of the processing.

There are some gem minerals which are not suitable for faceting or cabochoning, but are most suitable for carving and making ornamental items. This is another step of processing gem minerals. Minerals like quartz, serpantine marble, jade etc., could be used for this purpose.

At present we use diamond powder for most of our cutting and polishing of gem stones. The price paid to diamond powder used for this purpose, is anything around Rs. 75/- to Rs. 100/- per carat. According to Mor's scale of hardness, the hardness of corrumdum is 9 whereas the hardness of diamond is 10. In Sri Lanka we have a fair amount of non gem quality corrumdum deposits which can be used for making corrumdum powder for the purpose of replacing diamond powder as an abrasive for some varieties of stones. This is another aspect of processing of gem minerals.

The processing of gem minerals does not end at making of the finished good which is the cut and polished gem stone, carving or the abrasive. To my mind until you have prepared the product for marketing, the processing is not over.

The gem stones find their markets either with the ultimate user, trader-middle man, the related industry or with investors and collectors.

Buyer who is the ultimate user normally would look for one or two gem stones for making a piece of jewellery, keeping it as a souvenir or for whatever other purpose. For that kind of buyer what is needed is some individual gem stones in individual packets. The trader of course would look for a bigger quantity of stones mostly in parcels and similar or identical sizes, colour, clarity, etc. To satisfy him, grading and grouping is very important.

Related industry has a need similar to a trader but would definitely look for more specific grades, groups, sized, colour, etc. For the related industry, cut and polished stones are a raw material which should be forwarded in a manner that would satisfy the raw material needs.

Recently, we had the experience of canvassing a sale with a buyer of top quality stones, who at one stage selected 3 top quality blue sapphires for which he was ready to buy at Rs. 2 million. Over a dispute of the price of one stone the seller offered him 2 of the stones trying to withdraw one. The buyer reacted saying 'either you give me all 3 stones or I don't buy any'. Before this deal was negotiated out of about 10 top quality stones the buyer selected these 3 stones and placed them in a white velvet box with lengthwise groves in a manner suggesting that he was looking for 3 stones for a specific purpose. Basic condition for that sale was the buyer getting all 3 stones he needed.

Normally any merchandize unless properly packed and displayed will not achieve the ultimate goal of processing, which is the marketability. Gem stones are not different in this regard.