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## ENHANCING VALUE OF NIGERIAN GEMS THROUGH LAPIDARIES

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### ABSTRACT

Various geological reports on Nigerian Geology reviewed indicate that gemstones occur in all the geologic units of Nigeria. They are however concentrated within the 400km long and 150km wide NE-SW trending pegmatite belt of Central Nigeria. At present only one Lapidary situated in Jos exist in the country where gems are faceted and polished into different shapes. Surprisingly, demand for cut and polished Nigerian gems which have several uses is on the increase internationally. This paper will attempt to look at the various gems in Nigeria in the light of the mineral supply process. However, more emphasis will be laid on the techniques of processing the gems.

**KEYWORDS:** Gems, Lapidary, pegmatite, faceting, polishing

### INTRODUCTION

A gem sometimes called precious stone or stone is a naturally occurring material desirable for its beauty, valuable in its rarity, and sufficiently durable to give lasting pleasure (Ron, 2003). Statistics of gem production in Nigeria are meager. Stones found in Nigeria include; emerald, sapphire, amethyst, garnet, tourmaline, topaz and zircon. Available geological reports and visits to some mine sites tend to suggest that Nigeria host the largest quantity of colourless topaz in the world (Aga, 2004). The processing of gems and rocks is referred to as lapidary studies and the factory where stones are cut and polished is called a Lapidary. Nigeria at present has only one Lapidary situated in Jos.

Nigeria's art of gem cutting is at its infantile stage. There are less than 1000 persons in the country who have acquired such a skill (Aga, 2004). In order to achieve maximum results, a cutter must be familiar with factors that may affect the overall value of his/her finished stone. These include; refractive index, position of inclusion(s) if present, optical phenomena, cleavage planes, colour and so on.

### Geological Occurrence

Generally, gems can form in different geologic environments in the earth thus giving rise to various types including hydrothermal, pegmatite, magmatic and metamorphic and alluvial gems. In Nigeria, these various geologic environments exist within the four distinct units viz Basement, Younger Granite Complexes, Sedimentary Basins and Recent lavas and volcanic pipes (Ajibade, 1976). Fig. 1 shows these units and a pegmatite belt of Central Nigeria. The pegmatite occurs as a NE-SW trending belt about 400 km long and 150km wide beginning from Abeokuta area in the Southwest to Bauchi in the North Central parts. Occurrences of gemstones in Nigeria are reported within the Pan African Granites, Mesozoic Younger Granites and Proterozoic Pegmatite.

Mainly, emeralds and sapphires are hosted in quartzofeldspathic and aplitic veins within the Pan African Granites and at contacts between Sedimentary belt and the Pan African Granites in western Nigeria. In the Mesozoic Granites, the gems (emerald and sapphire) occur in roof zones and greisens within the rock, while the Paleozoic Pegmatite host mainly semi precious aquamarine, topaz, gem quality tourmaline and sapphire (Aga, 2004).

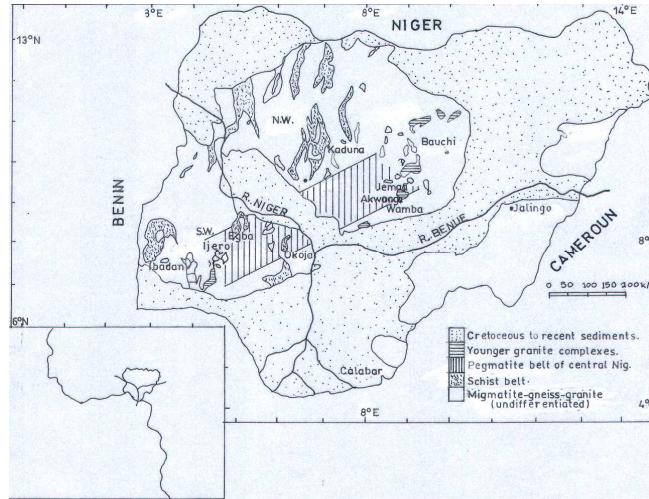


Fig. 1: Simplified Geological Map of Nigeria Showing Pegmatite Belt of Central Nigeria ( Ajibade *et al*, 1989)

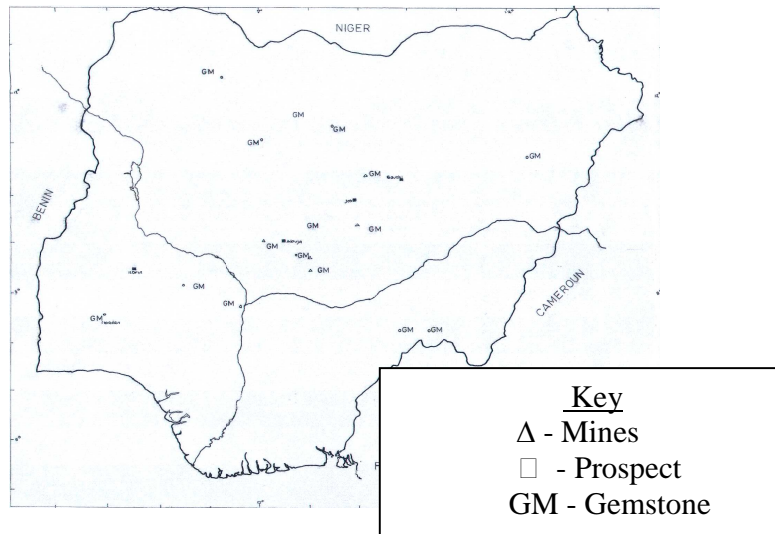


Fig. 2: Preliminary Location Map of Nigerian Gemstones (Modified After NIMAMOP Report,1999)

Fig. 2 shows a preliminary mineral location map of Nigerian gemstones. Classification of Nigerian gems is mostly based on size and recognized value (Tables 1). Companies adopt any of the three classifications based on Management preferences. Two out of the four precious stones known worldwide occur in Nigeria. These are emerald and sapphire which appear as green and blue respectively. The rest are semi precious stones (Table 2). Two varieties of garnet namely almandine and spessartite are common in Nigeria. Nigerian Tourmaline occur black/brown as schorl, pink as rubellite, blue as indicolite and green as verdelite.

In Nigeria, most original discoveries of gemstones have been as a result of observation accidents due to searches or operations for other substances. Most of the prospecting is done by amateur collectors and used to be concentrated on dipping up unconsolidated stream gravels, placer accumulations and certain bedrock masses.

Table 1: Classification of Nigerian Gems Based on Size

S/N	Company 1 Size(mm)	Company 2 Size(mm)	Company 3 Size(mm)
1	1	1	1
2	1-2	1-2	1-2
3	2-4	3-9	3-9
4	4-5	10-14	10-20
5	10-14	14-20	Above 20
	15 and above	-	-

Source: Aga (2004)

Table2: Classification of Nigerian Gems Based on Composition, Colour, Hardness and Specific Gravity

Gemstone	Precious Stones		Hardness	Specific Gravity
	Composition	Common Colour		
Emerald	$\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$	Green	7.50 - 8.50	2.71
Sapphire	$\text{Al}_2\text{O}_3$	Blue	9.00	3.99
Semi Precious Stones				
Amethyst	$\text{SiO}_2$	Purple	7.00	2.60
Aquamarine	$\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$	Blue	7.50	2.68
Garnet	$\text{Ca}_3\text{Al}_3(\text{SiO}_4)_3$	Red	6.50 - 7.50	3.50
Topaz	$\text{Al}_2(\text{F},\text{OH})_2\text{SiO}_4$	Colourless	8.00	3.56
Tourmaline	$\text{Na}(\text{Mg},\text{Fe})_3\text{Al}_6(\text{BO}_3)_3(\text{SiO}_{15})(\text{OH},\text{F})_4$	Black, Pink, Green	7.00 - 7.50	3.05
Quartz	$\text{SiO}_2$	Colourless	7.00	2.66
Zircon	$\text{ZrSiO}_4$	Red, Orange	7.50	4.00 4.70

Source: Bateman (1950)

## MATERIALS

With minimal effort and a nominal investment, it is possible to establish a successful gemological detective centre and accurately identify most gems. On a small scale, one can begin with just three basic instruments including the loupe, Chelsea filter and dichroscope. Used together, these three simple, portable instruments can enable one to properly identify almost eighty percent of the coloured gemstones encountered in Nigeria.

A hand magnifier sometimes called the Jeweler's loupe is used essentially to detect chips, cracks, symmetry in cutting, sharpness of facet edges and the presence of flaws. The Chelsea filter otherwise known as emerald filter is a pocket sized colour filter and is quite simple instrument. It is designed to allow only two wavelengths of light (red and green) to be transmitted. Nigerian sapphires could be separated from sapphire look alike with this instrument.

The calcite-type dichroscope is a small pocket sized tabular instrument used for transparent coloured gemstones. It differentiates stones based on differences in colour shades. The refractometer is used to measure the refractive index (R.I) of stones. Generally, the higher the R.I., the more brilliant the stone.

Gems exhibiting phosphorescence like Nigerian emeralds can be studied using (UV) lamps. A good microscope is necessary to magnify the materials under study and with a slight modification, the microscope can also be adopted for use as dichroscope, polariscope, refractometer and spectroscope (Matlins and Bonanno, 1986).

The spectroscope is a relatively small instrument that analyses light passing through a stone. The polariscope is used primarily to differentiate genuine from synthetic amethyst. Estimated cost of establishing a moderately good gemological factory with these simple equipments is conservatively put at N250,000.

## DISCUSSION

### Prefaceting and Faceting

Prefaceting and Faceting are techniques involved in the art of taking a rock or crystal and turning it into a more refined and polished product in a lapidary. The former include ; sorting, sawing and preforming while the later involves cutting and polishing. Dopping and calibrating are intermediary stages between prefaceting and faceting.

Nigerian gemstones extracted from vein, pocket vein and pocket occurrences are broken or crushed where necessary and concentrated by various combinations of hand picking, washing and screening. Most times, picking is repeated as many times as possible. This process is referred to as sorting and is dependent upon the percentage of flaws such as inclusions in a gemstone. Based on this, Nigerian gems are grouped into grades A, B, C and D in a decreasing order of purity. The term `shango` is used to describe grade D.

Certain techniques are used to remove identified stains or flaws to enhance the aesthetic values of the gemstone. For instance, sawing is carried out on gems to remove flaws identified during sorting. Such flaws may be noticed in the middle of the crystal, as observed in most Nigerian aquamarines. In such a case, the crystal is cut into two pieces along the crack line. A liquid such as oil or water is used to wash away debris and keep the stone and the saw blade from overheating, which could cause damage to both.

Preforming, otherwise known as grinding, usually done with silicon carbide wheels or diamond-impregnated wheels, is used to shape gemstones to a desired rough form, called perform. Sawing is similar to grinding but uses finer abrasives. Its purpose is to remove deep scratches left by coarser abrasives during grinding.

Dopping is the process where a preformed stone is attached to the flat end of a dop stick with wax as a cement over source of heat. Dop wax consists basically of a mixture of shellac and sealing wax, although quite often other ingredients such as beeswax and clay are added. Certain stones are susceptible to damage by heating and for these a lower temperature dop wax should be used.

A calibrate stone is a gemstone that has been cut to predetermined size, prior to faceting and polishing. Care must be taken at this stage and it requires serious concentration. Allowance of +0.2mm should be left in the sizes of the various shapes calibrated. This is achieved through the use of Vernier calipers, etc. The girdle is around three percent for all the stones. The performing machine can be used for calibrating.

Faceting is the art of taking a transparent rock or crystal and making flat faces (facets) on it to make the light refract and reflect from the stone better. The most commonly used facetrone in Nigeria is the NRS faceting machine (Fig.3). This machine is used in faceting gems into eight common shapes in the country viz pear, round, octagon, square, oval, marquise, triangle and heart. The cutting and polishing of the table( Fig 4) which must be fifty percent is achieved with the use of a table polisher.

Polishing is meant to remove all small quantities of stone and can be used, especially when faceting small stones, to do ultrafine shaping of the stone. Sometimes this is not achieved due to some errors like: less-meet, over-meet, unbalanced girdle, small table, large table, double facet, lapmark, quiet and girdle chips. These errors are corrected by refaceting, careful sanding, relapping and/or repolishing. Fig 4 shows parts of a faceted stone.

### Uses and Markets

Nigerian gems are primarily used for decoration purposes, in jewelry products and fashioning of materials. The typical products include : brooches, chips, bracelets, earrings, hair ornaments, crystal watches, flower vases, etc. For example, Nigerian tourmaline has been used as a calibration standard for nanometer (because of its piezoelectricity). It is also used as a standard to check possible effects of water soluble boron in mixed fertilizers .Also, both natural and synthetic corundum are ground and graded as abrasive; it is the major compound used in the polishing of eye glasses.

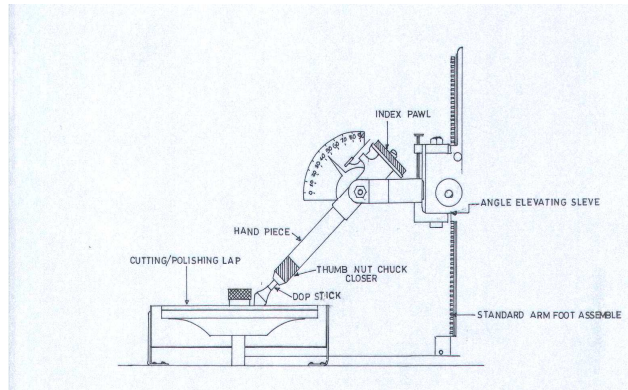


Fig.3 : Faceting Machine

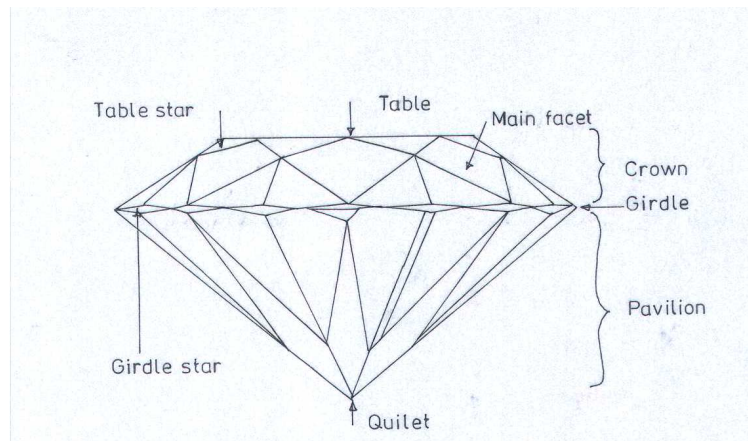


Fig. 4: Parts of a Faceted Stone

Gemstones of Nigerian origin are sold in their raw, sawn, preformed, calibrated or cut and polished forms. Over ninety percent of the gemstones are sold in their crude form and exported out of the country. Emerald and sapphire are relatively more expensive than the semi-precious types. Prices of preformed stones are approximately seventy five percent higher than rough ones. The cut and polished stones are almost three times more expensive than the rough ones. A visit to most online shops reveal that sawn and preformed stone from Nigeria are in high demand most especially rubellite and topaz.

#### CONCLUSION

Geological evidences indicate that different gemstones occur in the country, especially within the pegmatite belt. Most of the gems are exported in rough forms and therefore sold at a value one third of the ones polished. Techniques required to enhance these gems are simple and the basic equipments required are not quite expensive. The need to have more lapidaries in the country is therefore suggested.

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