GEM LOCALITIES OF SRI LANKA

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Even though Sri Lanka, in relation to its surface area is the most dense gem-bearing country in the world, its true gem potential is very poorly known and much of the research investigations have been directed at academic pursuits. Large areas known to be gem-bearing have been mined for gems by licit as well as illicit miners and the chance discovery of a gemstone triggers further gem mining and this 'hearsay' method still appears to be the practical method of gem exploration in the country. Modern scientific techniques have hardly been used for gem exploration in Sri Lanka and the apparent success of the local gem miners in unearthing valuable gemstones could perhaps be the reason for the lack of emphasis on the application of newer scientific techniques on gem exploration. While there may be divergent views concerning the real need for locating more gem fields and increasing the actual annual production of gemstones, the need to inventorize the natural resources of the country cannot however be disputed.

Very little scientific work has been carried out on the gem potential of the Highland group rocks where Sri Lanka's gem minerals are found (Fig. 1). The earlier work resulted in determining the percentages of heavy minerals found in the stream sediments and identification of source rocks. The abundance of rare minerals such as taaffeite, sihhalite, olivine, ekanite, diamond etc. were not studied and moreover the potential of valuable elements such as gold, thorium, uranium, tin, tungsten, platinum, niobium, tantalium were rarely considered (Table 1 and 2).
Gem minerals are by far the most economically valuable mineral resource in Sri Lanka and it is imperative that the resource estimates be known and inventorized. Inspite of the fact that gems form the major mineral resource of the Island, there was no proper map that indicated Sri Lanka's gem fields and the compilation of such a gem resource map had therefore become a national need.

ENVIRONMENTAL IMPACTS OF GEM MINING

In the Ratnapura district, gem mining is considered to be a major cause of erosion and sedimentation. Among the interrelated factors identified were :

i) Stream bank mining

ii) Removal of vegetation cover during gemming

iii) The process of washing gem 'illam' in water bodies where clay and silt particles are added to rivers, streams, canals, etc.

iv) Deposition of sediments in rivers, streams and canals when mine waters are discharged from working mines

v) Erosion of soils from unstable soil heaps (mine spoils) that are accumulated around gem pits.

The resurgence of Malaria in some parts of the country has also been attributed to gem mining, particularly to illicit mining, where the pits are not filled back and where water accumulates providing breeding grounds for the mosquitoes.

WHAT ARE GEMS?

Gems may be described as those specimens of minerals or organic materials used for personal adornme nt that posses beauty, rarity, and durability. Organic materials used as gems include pearl, coral, amber, and jet. Gems are divided into two classifications:

i) diamonds and

ii) coloured stones.

In its broadcast sense, the term "colored stones" is used in the jewellery trade to refer to all gem minerals and organic gem materials, but not diamonds. In a narrower sense, pearls are also eliminated from this classification and treated separately; Diamond is considered separately for several reasons.

i) In its finer qualities it is usually nearly colorless, whereas the finer qualities in the major vari eties of the other gem minerals are colorless;

ii) its physical and optical properties are sufficiently different from other gems to make its beauty an d use totally distinctive;

iii) unlike good-quality coloured stones, diamonds have been consistently available in both quantity and quality to permit standardization in general marketing procedures and pricing.

FACTORS THAT AFFECT THE VALUE OF GEMSTONES

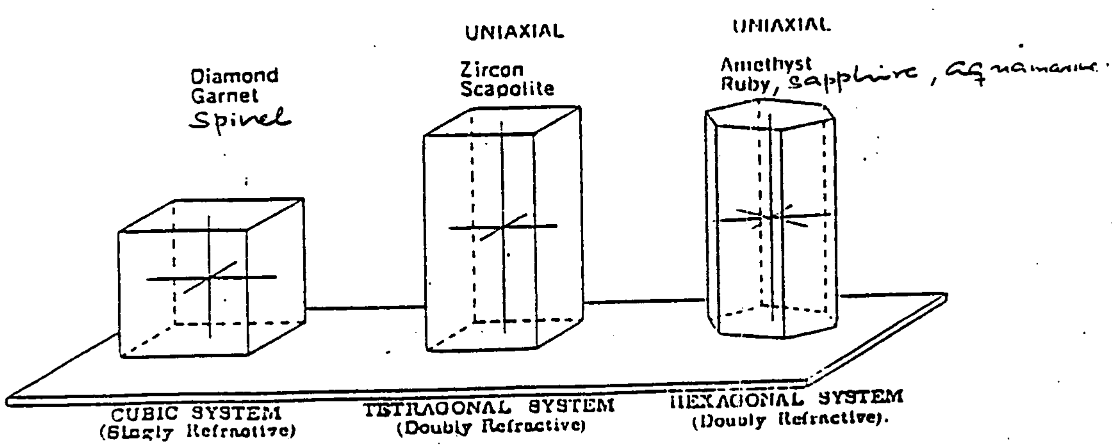
The basic factors that contribute to the value of a gemstone are;

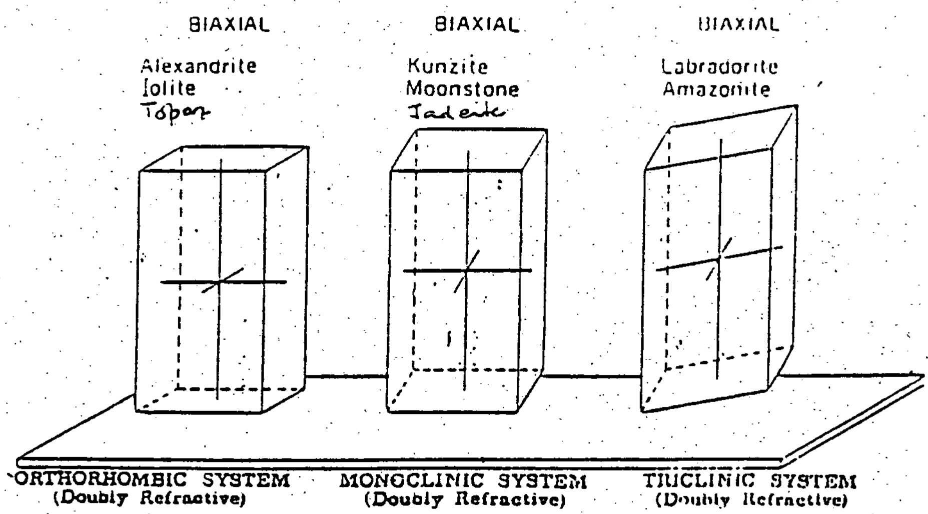
a) BEAUTY (colour, luster, perfection of cutting etc.)
b) DURABILITY
c) RARITY,
d) DEMAND (or VOGUE)
e) TRADITION, and
f) PORTABILITY.

CRYSTAL SYSTEMS

For convenience of study and reference, crystals are divided into six great systems, described by t he comparative length and angular relation of their crystallographic axes. There must be at least three axes to describe a crystal, and in one case four are necessary.

MODELS OF THE SIX CRYSTAL SYSTEMS





USEFUL FACTORS IN GEM IDENTIFICATION

Specific gravity

The quantity of matter in a given space in referred to as density. Expressed scientifically, it is the mass of any substance contained in unit volume. The densities of gemstones depend on the closeness with which their atoms are packed and on the weight of those atoms. The specific gravity of a gemstone is the ratiou of its density to the density of water. Specific gravity is technically defined as the ratio obtained by dividing the weight of a body by the weight of an equal volume of distilled water at a temperature of 4°C.

$$SG = \frac{\text{Weight in Air}}{\text{Weight in Air - weight in water}}$$

REFRACTIVE INDEX

Optical density varies from material to material and thus from gem species to gem species. This is very useful in the identification of gem species. The optical density of zircon for example, is much greater than that of quartz. This means that light is slowed down much more as it enters zircon than when it enters quartz. The comparative ability to slow down and thus to bend or refract light is called its refractive index (RI).

Refractive index is defined as the ratio of the speed of light in air to the speed of light in a substance.

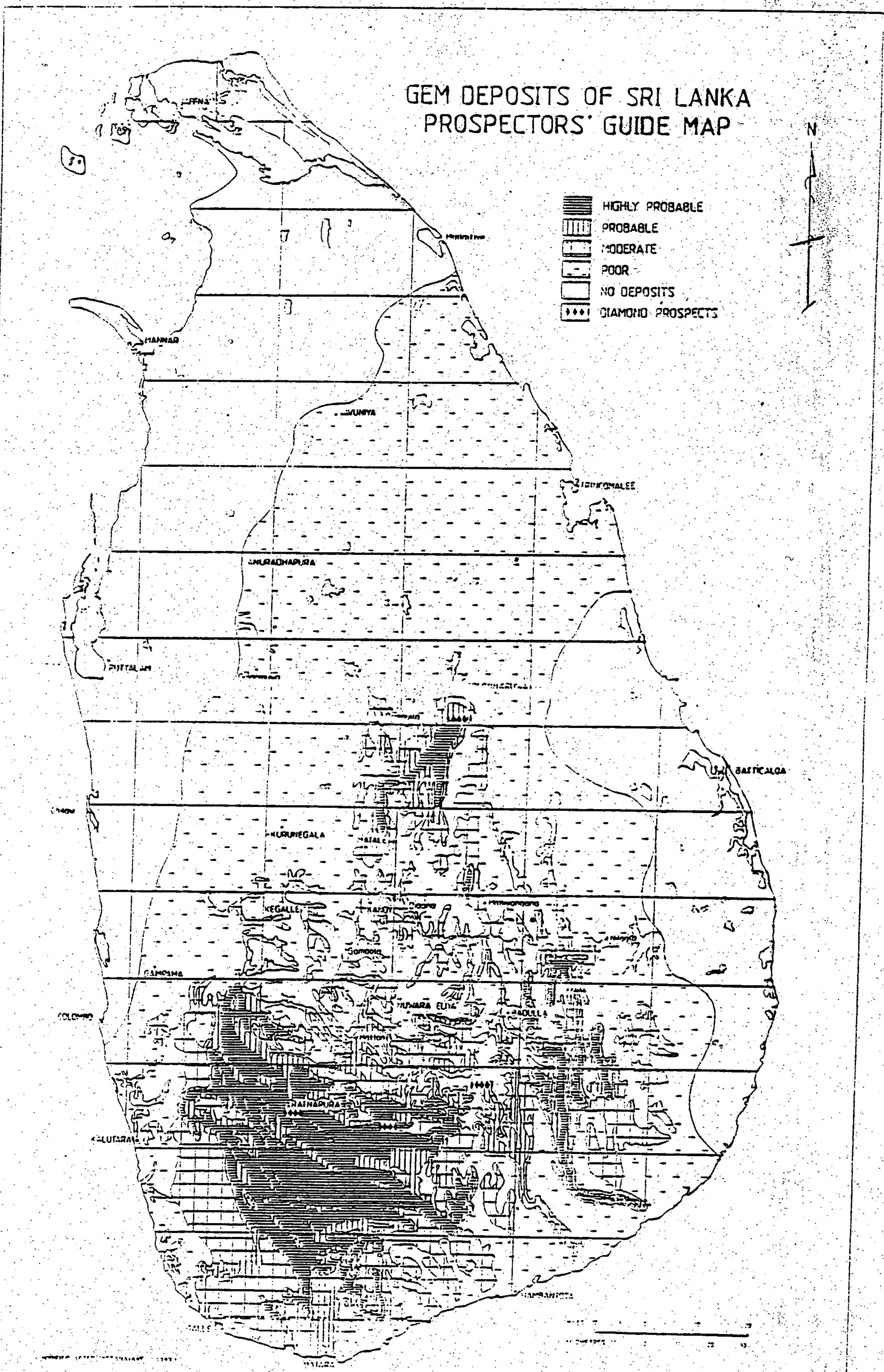
$$RI = \frac{\text{Speed of light in Air}}{\text{Speed of light in the substance}}$$

SPECIFIC GRAVITY AND REFRACTIVE INDICES OF THE COMMON GEM MINERALS.

Name	SG	RI
Zircon - High	4.70	1.925-1.984
Zircon - Low	4.00	1.78-1.81
Corundum	4.00	1.76-1.77
Spinel	3.60	1.714-1.736
Topaz	3.53	1.610-1.620
Diamond	3.52	2.417
Tourmaline	3.06	1.62-1.64
Quartz	2.66	1.544-1.553
Glass	2.30-4.50	1.55
Opal	2.15	1.44-1.46

HARDNESS

Hardness is the resistance a gemstone or other material offers to scratching or abrasion. The basic idea of hardness is that a harder stone will scratch a softer one, if a sharp point or an edge of the harder material is drawn across the softer one (Table 3).



GEM DEPOSITS OF SRI LANKA
PROSPECTORS' GUIDE MAP
N
HIGHLY PROBABLE
PROBABLE
MODERATE
POOR
NO DEPOSITS
DIAMOND PROSPECTS
JAFFNA
MANNAR
VAVUNIYA
TRINCOMALEE
ANURADHAPURA
PUTTALAM
BATTICALOA
KURUNEGALA
MATALE
KEGALLE
KANDY
GAMPAHA
COLOMBO
NUWARA ELIYA
BADULLA
RATNAPURA
KALUTARA
HAMBANTOTA
GALLE

Fig 1

GEMSTONES OF SRI LANKA

Mineral	Formula
Corundum	Al_2O_3
Chrysoberyl	$BeO.Al_2O_3$
Beryl	$Al_2Be_3(Si_6O_{18})$
Topaz	$Al_2(F.OH)_2SiO_4$
Tourmaline	$Na(Fe)_3Al_6B_3Si_6O_{27}$ (OH,F)
	$Mg_3Al_2(SiO_4)_3$
Garnets	$Fe\ Al_2\ (SiO_4)_3$
	$(MgFe)_3.Al_2(SiO_4)_3$
Spinel	$MgO.Al_2O_3$
Zircon	$ZrSiO_4$
Quartz	SiO_2
Feldspar (moonstone)	$KAlSi_3O_8$
Cordierite	$(Mg.Fe)_2Al_4Si_5O_{18}$
Andalusite	Al_2SiO_5
Apatite	$Ca(F.Cl)\ Ca_4\ (PO_4)_3$
Cornarupine	$MgAl_2SiO_6$
Sinhalite	$Mg.Al.BO_4$
Taffeite	$Mg.Be.Al_4O_8$
Ekanite	$K(Ca,Na)_2Th(Si_8O_{20})$

Table 1

IMPORTANT MINERALS ASSOCIATED WITH GEMS

Xenotime	YPO_4	Nuwaraeliya – Pegmatite
Ambligomite	$Li(AlF)PO_4$	Ratnapura – Alluvial
Tsheffkinite	$(Ce, La)_2Ti_2(O_4/Si_2O_7)$	Balangoda, Limstone -Alluvial
Picroilmenite	$(Mg, Fe)TiO_3$	
Fergasonite	$Y(Nb, Ta)O_4$	$> 4\% U_3O_8$
Gleikielite	$MgTiO_3$	
Niobium Rutile	$Fe_{X(11)}(Nb, Ta)_{2x}Ti_{1-x}O_2$	
Alanite (Ortlit)	$(Ca, Ce)_2(Fe^{+2}, Fe^{+3})Al_2(O/OH)SiO_4/Si_2O_4$	
Thorite	$ThSiO_4/(Th, O)_2$	river gravel, Pegmatite, Mica veins
Zirkelite	$(Ca, Se, Y, Fe)(Ti, Zr, Th)_3O_7$ $1 - 14\% U_2O_8$	
Samarskite	$(Y, U, Ca)(Nb, Fe^{+3})_2(O, OH)_6$	
Mikrolith	$(Ca, Na)_2(Ta, Nb, Ti)_2O_6(O, OH, F)$	
Aeschynite	$(Ce, Th, Ca)(Nb, Ti, Ta)_2O_6$	
Niobite	$(Fe, Mn)(Nb, Ta)_2O_6$	
Tantalite	$(Fe, Mn)O_5$	
Chromite	$FeO.Cr_2O_3$	river gravels
Cassiterite	SnO_2	Pegmatite
Baddeleyite	ZrO_2	gem gravels
Psilomelane	Mn_8O_{16}	
Gadolinite	Be, SiO_4	
Clinohumite	Mg, Flousilicate	
Serendibite	A Borosilicate of Aluminium	

Table 2

RELATIVE HARDNESS

OF THE COMMON GEM MINERALS

AND RELATED SUBSTANCES

Asterisks (*) indicate other than gem substances. Where two numerals appear, the hardness varies between those two figures.

Diamond	*10*
Corundum	*9*
Synthetic Corundum	9
Chrysoberyl	8½
Spinel	8
Synthetic Spinel	8
Topaz	*8*
Beryl	7½ - 8
Synthetic Emerald	7½ - 8
Almandite (Garnet)	7½
Zircon	7 - 7½
Rhodolite	7 - 7½
Pyrope (Garnet)	7 - 7½
Tourmaline	7 - 7½
Spessartite (Garnet)	7 - 7½
Grossularite (Garnet)	7
Quartz	*7*
Chalcedony (Quartz)	6½ - 7
Synthetic Rutile	6½ - 7
Peridot or Olivine	6½ - 7
Jadeite (Jade)	6½ - 7
Andradite (Garnet)	6½ - 7
Spodumene	6 - 7
Steel File*	6 - 7
Marcasite	6 - 6½
Pyrite	6 - 6½
Microcline (Feldspar)	6 - 6½
Orthoclase (Feldspar)	*6*
Oligoclase (Feldspar)	6 - 6½
Nephrite (Jade)	6 - 6½
Labradorite (Feldspar)	6
Iridium*	6
Hematite	5½ - 6½
Opal	5½ - 6½
Glass	5 - 6 3/4
Apatite	*5*
Lapis-Lazuli	5 - 6
Turquoise	5 - 6
Natural Glass	5½
Tooth Enamel*	5
Palladium*	4½
Iron*	4 - 5
Platinum*	4 - 4½
Brass*	4
Shell	3½
Coral	3½
Jet	3 - 4
Copper Coin*	3
Pearl	2½ - 4
Ivory	2½
Tortoise-Shell	2½ - 3
Silver*	2 - 2½
Amber	2 - 2½
Gold*	2 - 2½
Plastic Group*	1½ - 3
Lead*	1½
Talc	1
Graphite	1
Wax	½
Fingernail	*2½*
Knife blade	*< 5½*

Table 3