GEMOLOGY, JEWELRY AND THE JEWELRY BUSINESS

A 2019 Winter Course in OLLI at VPC

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Moderator

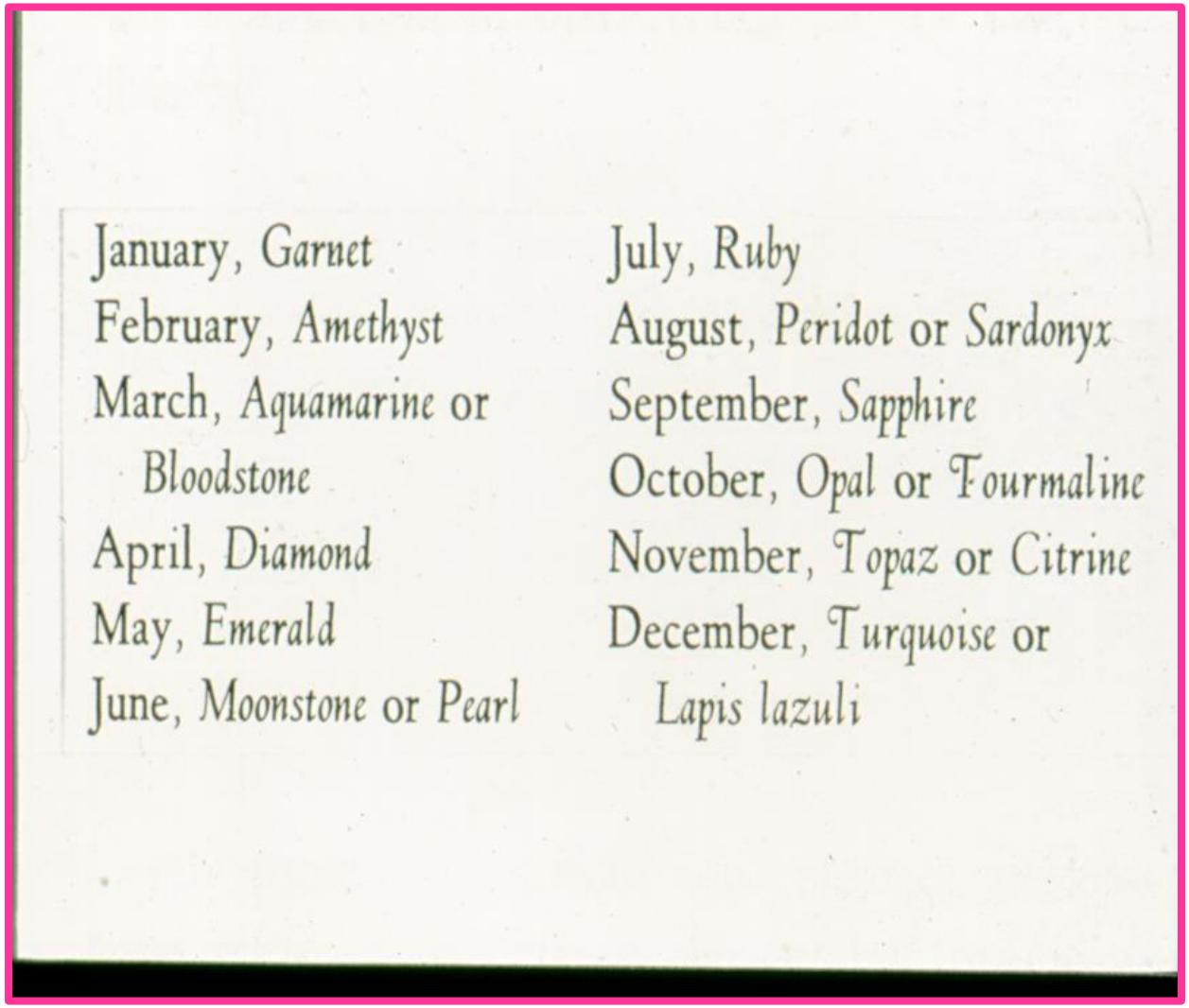
Some Goals and Objectives of the Course

1) Share my experiences with the Gem Business
2) Engender a greater appreciation for a range of gem stones and fine jewelry
3) Understand some of the basic physical and chemical properties of diamonds and colored stones
4) Discuss the instruments used in gem identification, evaluation and authentication
5) Sharpen your skills in buying and selling jewelry
6) 'Show and Tell' venue to discuss your experiences, and view your precious jewelry treasures
7) Perspectives from two local independent Jewelry Store owners who will add to the discussion of jewelry design, repair, appraisals and antique jewelry.


PRECIOUS
GEMS CO.

Cullinan Diamond is the largest gem-quality rough diamond ever found, weighing 3,106.75 carats

Birth Stones according to the American National Retail Jewelers Association 1912



January, *Garnet*
February, *Amethyst*
March, *Aquamarine* or *Bloodstone*
April, *Diamond*
May, *Emerald*
June, *Moonstone* or *Pearl*
July, *Ruby*
August, *Peridot* or *Sardonyx*
September, *Sapphire*
October, *Opal* or *Tourmaline*
November, *Topaz* or *Citrine*
December, *Turquoise* or *Lapis lazuli*

Zodiac, Guardian Angel, Apostolic and Synthetic etc. lists of birthstones.

- Take you pick and any gift is appreciated!

General Ground Rules to Consider when purchasing jewelry

- Typical markups in jewelry stores are 200-300 percent
- Perfecting the art of Haggling (not just for trips to the Caribbean, Mexico or Turkey)
- Ways to analyze a jewelry piece to minimize impulse buying
- Many jewelry store 'clerks' know little about their merchandise and provide incorrect information
- The pitfalls of overseas purchases
- The New York market and 47th street
- Trunk shows, discount days and special offers
- General guidelines for Investing in precious metals and gems
- Protecting and insuring your valuables
- Buy to enjoy your jewelry purchases

Diamonds: the four Cs

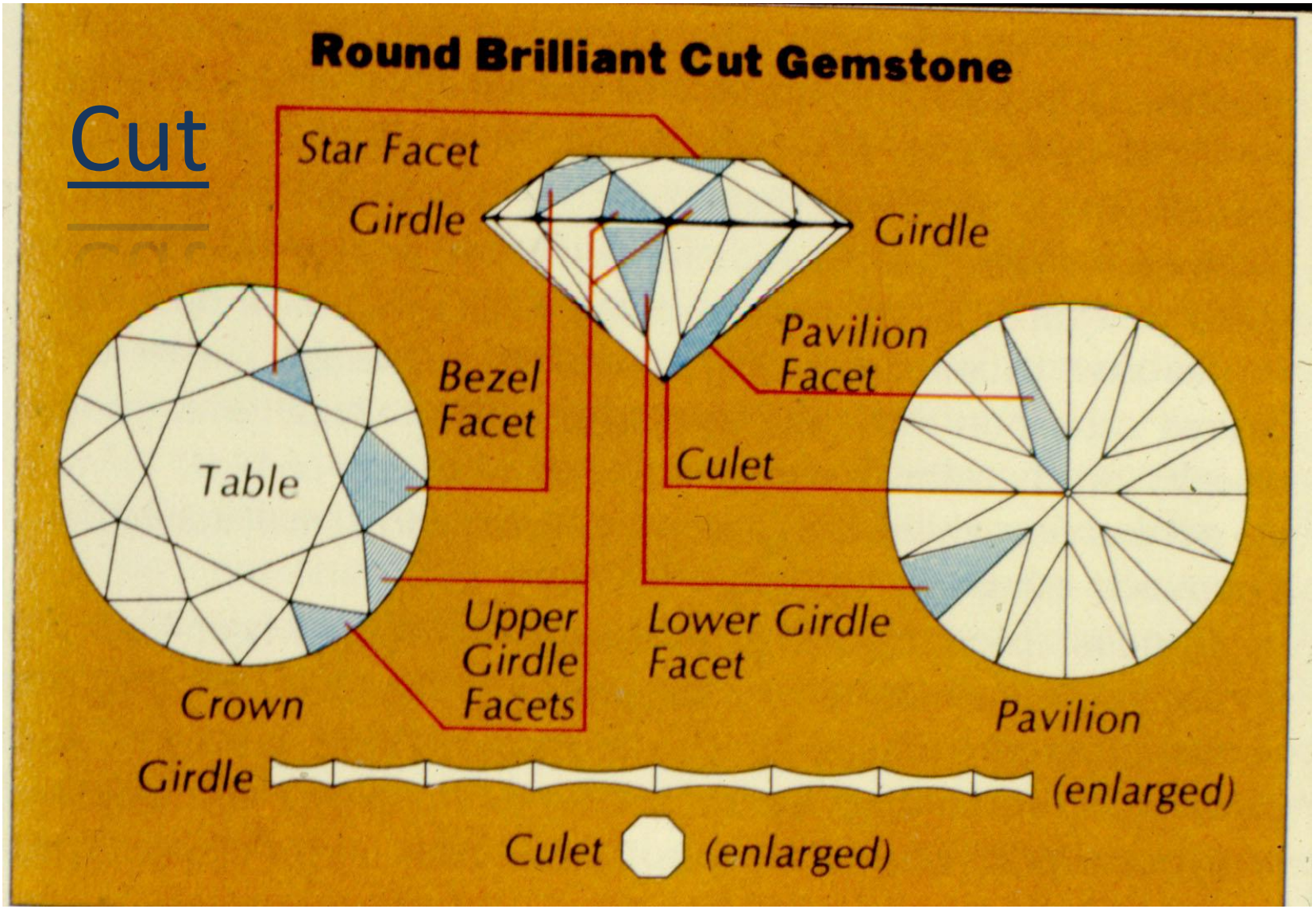
The Four evaluation criteria for Diamonds; these criteria are also used with other gem stones as well, but with less precision. Only Diamonds and Precious metals fall into fairly standardized criteria making them a commodity.

- 1. Carat
- 2. Cut
- 3. Clarity
- 4. Color

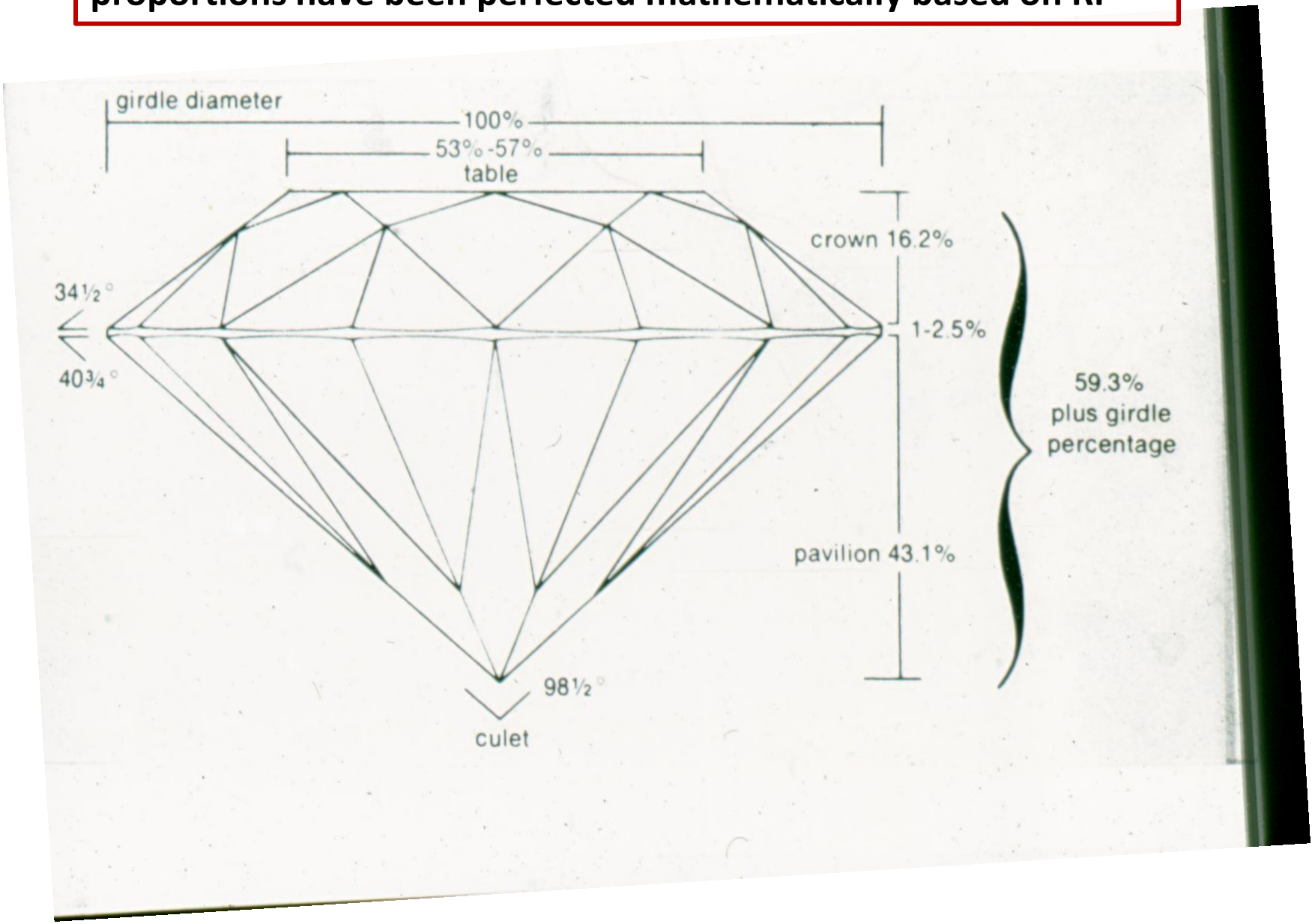
CARAT. A unit of weight for diamonds and other gems. The carat formerly varied somewhat in different countries, but the metric carat of .200 grams, or 200 milligrams, was adopted in the United States in 1913 and is now standardized in the principal countries of the world. There are 100 points in a carat. It is sometimes incorrectly spelled karat, but in the USA karat refers only to the fineness of pure gold and gold alloys.

There are 100 points in a 1 carat stone which weights 200 mg; a 5 carat stone weights just 1 gram.

Cut


Round Brilliant Cut Gemstone
Star Facet
Girdle
Girdle
Pavilion Facet
Bezel Facet
Table
Culet
Upper Girdle Facets
Lower Girdle Facet
Crown
Pavilion
Girdle
(enlarged)
Culet
(enlarged)

Ideal Proportions of a round brilliant diamond and terminology: proportions have been perfected mathematically based on RI



Standard Cutting Styles

- The modern round brilliant consists of 58 facets or 57 if the culet is excluded; 33 on the crown (the top half above the middle or girdle of the stone) and 25 on the pavilion (the lower half below the girdle).
- Older diamond jewelry often had fewer facets like the old miner and European cuts in older pieces.
- Step cut diamonds like an emerald or pear shape cut usually have the same number of facets as the round brilliant cut.

Other Popular Cuts that are less expensive because they save a greater percentage of the rough material

- **Princess Cut** diamond which is a square cut diamond with sharp corners and generally 58 facets

- **Radiant Cut** is similar but more rectangular with trimmed corners.

Color of ‘Colorless’ Diamonds

D-Z (entire alphabet starting with D then E,F,G,H,I,J,K,L,M-----Z which is a Canary Diamond)

Color grading measures the amount of yellow in the stone and is as important as the other three Cs in street value. This is where the dealer can and often does deceive the retail jeweler and retail customer.

Need a master stone set or known standard stones with morning eyes to accurately grade color (north light)

1. DIAMONDS GRADED D,E AND F ARE COLORLESS
2. DIAMONDS G,H,I,J ‘FACE-UP’ COLORLESS
3. DIAMONDS K,L,M,N AND BELOW SHOW INCREASING YELLOW FACE-UP (VISIBLE TO THE NAKED EYE)

WHEN YOU GET TO Z IT BECOMES A CANARY DIAMOND

MANY DIAMONDS FLUORESCE IN ULTRAVIOLET LIGHT (DOES NOT CHANGE VALUE)

CLARITY UNDER 10 POWER LOOP (TRAINED OBSERVER WITH EXCEPTIONAL EYESITE)

1. FLAWLESS/INTERNALLY FLAWLESS
2. VVS-1, VVS-2,(VERY, VERY SLIGHT)
3. VS-1,VS-2, (VERY SLIGHT)
4. SI-1,SI-2, (SLIGHTLY IMPERFECT)
5. I-1, I-2, I-3 (IMPERFECT AND VISIBLE TO THE NAKED EYE)

A Good quality jewelry store stone ‘on average’ is a J color, SI-2 clarity with fair make.

Misleading grading is a buyer’s risk

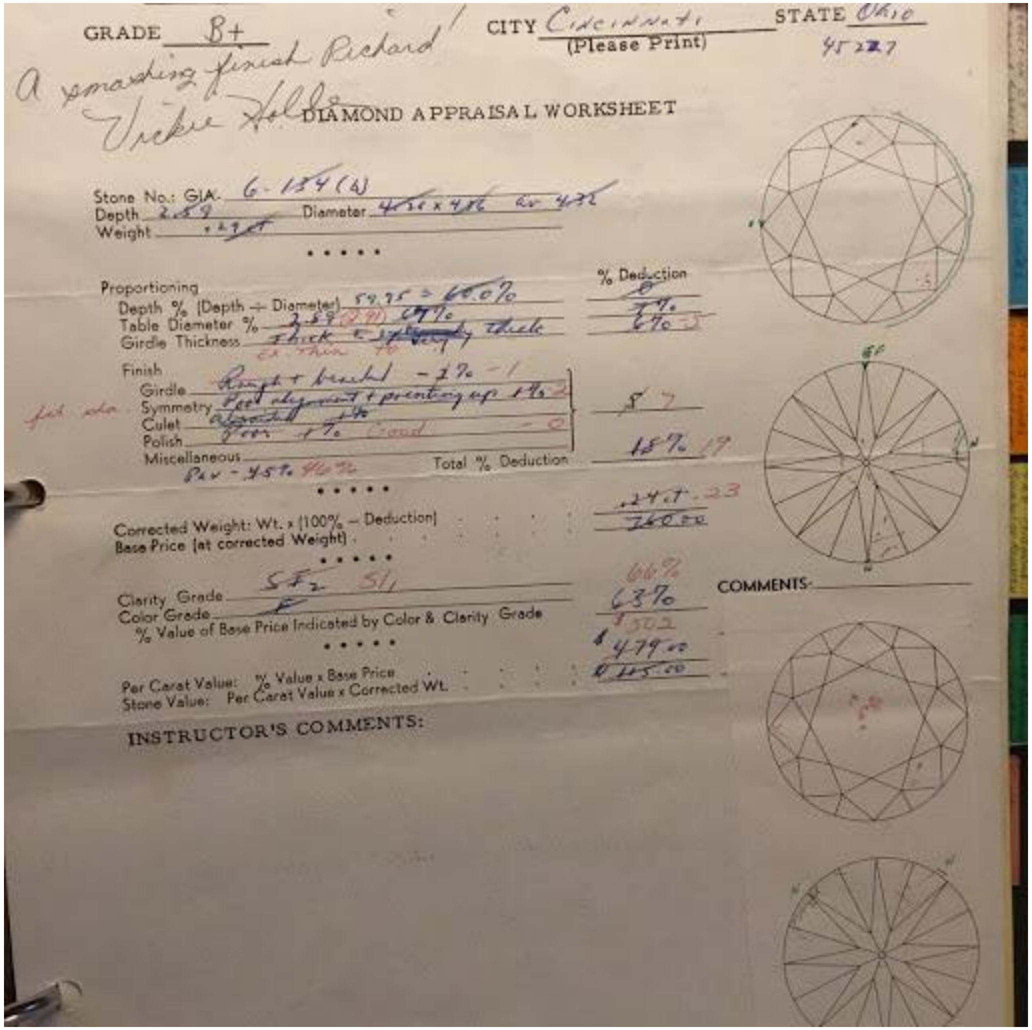
How can the buyer know the value of this ‘blind’ commodity

- The reputation of the merchant (the average jeweler is untrained)
- Appreciate that the average jewelry store markup is 2-300 percent (wiggle room to haggle and price compare between stores)
- Certificates from reputable gem testing labs such as the GIA and and AGL (costs increase with size of stone—cost generally about 100 dollars).
- Get a second opinion and compare prices between two or more dealers.
- Gem pricing guides or tables such as Rapport or the Gem guide (most major jewelry stores subscribe)

Selling to a ‘dealer’ is hazardous; consider getting replacement cost appraisals, second opinions and look at auction houses and internet sites

Precious gem investments carry the same risk as other tangibles and you need to know the territory to maximize your return

Diamond Grading


GRADE B+

CITY Cincinnati (Please Print) STATE Ohio

DIAMOND APPRAISAL WORKSHEET

Stone No.: GIA

Depth

Diameter

Weight

Proportioning

Depth % (Depth ÷ Diameter)

Table Diameter %

Girdle Thickness

% Deduction

Finish

Girdle

Symmetry

Culet

Polish

Miscellaneous

Total % Deduction

Corrected Weight: Wt. x (100% − Deduction)

Base Price (at corrected Weight)

Clarity Grade

Color Grade

% Value of Base Price Indicated by Color & Clarity Grade

Per Carat Value: % Value x Base Price

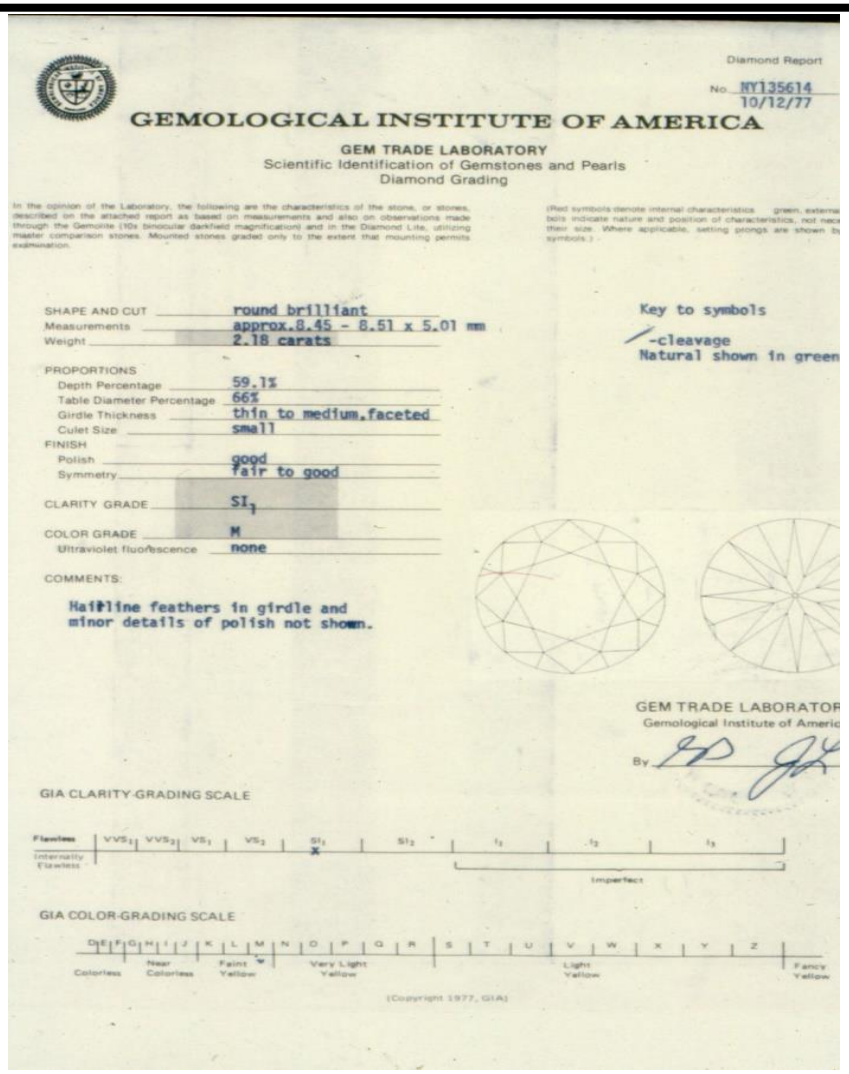
Stone Value: Per Carat Value x Corrected Wt.

INSTRUCTOR'S COMMENTS:

COMMENTS:

A GIA certificate costs **$64** for a 1/2 carat diamond up to **$120** for a 2 carat stone.

Certificated Diamonds; GIA, AGS, (EJL & IJL) are the standards for quality certificates



Diamond Report

No. NY135614
10/12/77

GEMOLOGICAL INSTITUTE OF AMERICA

GEM TRADE LABORATORY
Scientific Identification of Gemstones and Pearls
Diamond Grading

In the opinion of the Laboratory, the following are the characteristics of the stone, or stones, described on the attached report as based on measurements and also on observations made through the Gemolite (10x binocular darkfield magnification) and in the Diamond Lite, utilizing master comparison stones. Mounted stones graded only to the extent that mounting permits examination.

(Red symbols denote internal characteristics, green, external; bolls indicate nature and position of characteristics, not nec their size. Where applicable, setting prongs are shown b symbols.)

SHAPE AND CUT: round brilliant
Measurements: approx.8.45 - 8.51 x 5.01 mm
Weight: 2.18 carats

PROPORTIONS
Depth Percentage: 59.1%
Table Diameter Percentage: 66%
Girdle Thickness: thin to medium,faceted
Culet Size: small

FINISH
Polish: good
Symmetry: fair to good

CLARITY GRADE: SI_1

COLOR GRADE: M
Ultraviolet fluorescence: none

COMMENTS:

Hairline feathers in girdle and minor details of polish not shown.

Key to symbols

/-cleavage
Natural shown in green

GEM TRADE LABORATOR
Gemological Institute of Americ

By

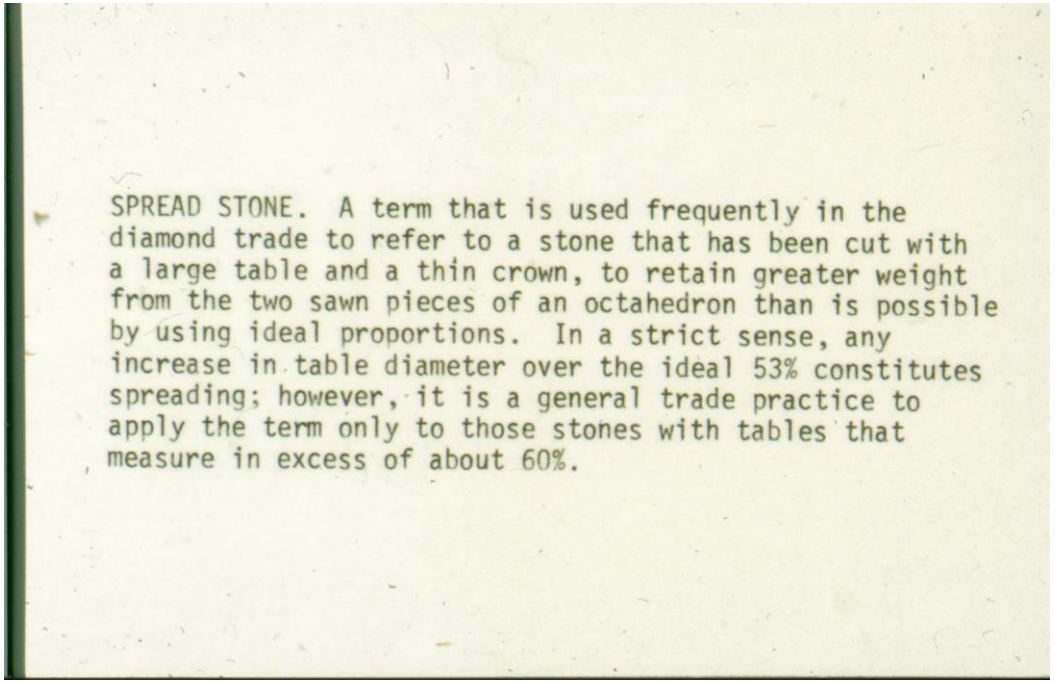
GIA CLARITY-GRADING SCALE

Flawless | VVS_1 | VVS_2 | VS_1 | VS_2 | SI_1 | SI_2 | I_1 | I_2 | I_3
Internally Flawless
Imperfect

GIA COLOR-GRADING SCALE

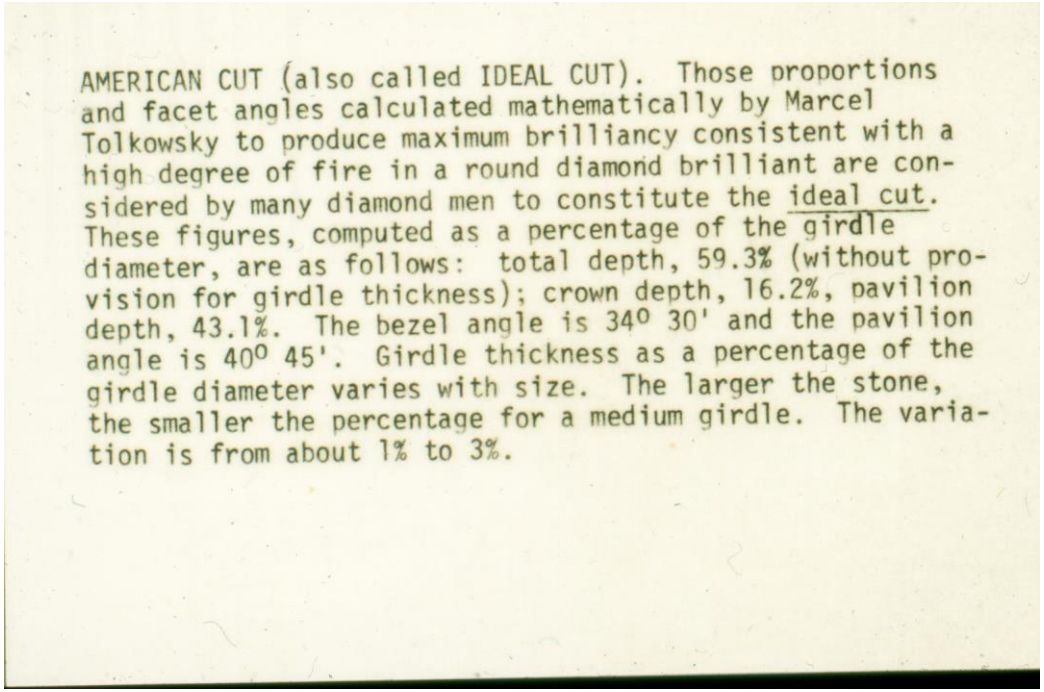
D E F G H I J K L M N O P Q R S T U V W X Y Z
Colorless | Near Colorless | Faint Yellow | Very Light Yellow | Light Yellow | Fancy Yellow

Examining Rough; Diamonds are Cut to Maximize Weight



SPREAD STONE. A term that is used frequently in the diamond trade to refer to a stone that has been cut with a large table and a thin crown, to retain greater weight from the two sawn pieces of an octahedron than is possible by using ideal proportions. In a strict sense, any increase in table diameter over the ideal 53% constitutes spreading; however, it is a general trade practice to apply the term only to those stones with tables that measure in excess of about 60%.

The Diamond Cutters try to maximize weight



AMERICAN CUT (also called IDEAL CUT). Those proportions and facet angles calculated mathematically by Marcel Tolkowsky to produce maximum brilliancy consistent with a high degree of fire in a round diamond brilliant are considered by many diamond men to constitute the ideal cut. These figures, computed as a percentage of the girdle diameter, are as follows: total depth, 59.3% (without provision for girdle thickness); crown depth, 16.2%, pavilion depth, 43.1%. The bezel angle is 34° 30' and the pavilion angle is 40° 45'. Girdle thickness as a percentage of the girdle diameter varies with size. The larger the stone, the smaller the percentage for a medium girdle. The variation is from about 1% to 3%.

Diamonds

Diamond melee are round cut diamonds of 10 points or less

Baguettes are small step cut rectangular diamonds
(both melee and baguettes are used in making jewelry)

Diamonds come in many colors and are extremely valuable when natural (blue, pink, yellow) and of gem quality

Hope Diamond

Diamonds are often treated with heat, irradiation and even laser. Colored diamonds are called ‘fancy diamonds’

Laser, Cyclotron cause a Champaign Color

Heated to improve color

ARGUMENTS WHY TO INVEST IN DIAMONDS

Inflation proof like other valuables with limited supply or rarity?

Portable concentrated value (can be eaten)

Can be worn and shows social status

Durability

Estate tax advantage; give to the kids or charity

ARGUMENTS WHY NOT TO INVEST IN DIAMONDS

Blind commodity; you must be a dealer or know the territory or have an agent

New mining sources for diamonds or new technology to manufacture diamonds to challenge the cartel's price fixing

Can get lost, stolen or exchanged by a jeweler with no way to trace it; not like a work of art

Easy to buy but hard to sell

Common Diamond Substitutes

Moissanite

Moissanite is a form of silicon carbide and is usually produced synthetically.
Because of its hardness (9.5 on the Mohs scale), it is perhaps the diamond imitation material that is closest to the real thing in terms of durability.
Although it looks quite similar to real diamond, moissanite has different physical properties that result in optical differences.
For example, moissanite is more brilliant than diamond and also sparkles in more colors when light enters it.

Cubic Zirconia

Cubic zirconia is a form of zirconium dioxide and is created synthetically.
This is one of the most popular diamond substitutes not only because it has optical properties similar to those of the real thing but also because it is very cheap.
However, cubic zirconia is significantly softer (8.5 on the Mohs scale), and this is why it easily accumulates scratches over time when worn. This stone is also much heavier than diamond.

Wholesale Diamond price estimates per carat a year ago

- 1 carat D/Flawless- $18,360
- 1 carat E/Flawless- $10,600
- 1 carat D/VVS1- $12,250
- 1 carat J/Flawless- $5,280

- 1 carat J/SI2 (an average good quality jewelry store stone)- $3,525
- 1 carat M/SI2-$2,500
- 2 carat D/Flawless- $39,000/carat

Understanding the Gold, Silver and Platinum trade

Gold Content

- 24 Karat=pure gold (a color that cannot be duplicated)
- 18 Karat or marked 750= 75 percent gold
- 14 Karat or marked 585= 58.5 percent gold
- 12 Karat or market 500=50 percent gold
- Unless you have coinage or a wafer or bar of gold, the dealer usually cheats a little on gold content. Many jewelry pieces are gold plated; look for the stamp.

Silver

- Pure silver is 99.99 percent silver
- Sterling Silver is 92.5 percent silver (some copper to add strength)
- Coin silver is generally about 90 percent silver

Platinum and platinum group metals—iridium, rhodium, osmium, palladium and ruthenium

- Platinum is harder, more durable, hypoallergenic, lustrous, denser, scratch and tarnish resistant than gold.
- Look for marks that document platinum content
- Currently, it is less expensive and valuable than gold

Gold Chains: look for Karat markings; **weigh and calculate gold or silver content**; then estimate value based on these calculations and the gold future price

Many creative names for chain design such as snakes, ropes and cobra.

Many chains are made in Italy and the chain making process is quite automated. When buying, check the clasps (gold?), smoothness, workmanship and uniformity. You must distinguish plated goods or items with plated components from the solid gold, silver or platinum items. Offer to buy a chain at 50% over the gold content price and ignore any design features. Gold chain is gold chain and, in my opinion, branding means nothing.

Gold Alloys add Color

Yellow Gold (22K)	Gold 91.67% Silver 5% **Copper** 2% **Zinc** 1.33%
Red Gold (18K)	Gold 75% **Copper** 25%
Rose Gold (18K)	Gold 75% **Copper** 22.25% Silver 2.75%
Pink Gold (18K)	Gold 75% **Copper** 20% Silver 5%

More Colors of Gold

- Yellow—copper
- Green gold—silver, cadmium
- Purple gold—aluminum
- Lilac—zinc
- Blue gold—iron
- White gold—primarily nickel (nickel allergies) but also some palladium and other metals
- Purple--aluminum and zinc

Tricolor Gold Items

❖ Four Methods to Invest in Gold:

1. Buying Scrap Gold
2. Buying Gold Bullion, wafers or coins
3. Buying Gold Futures
4. Buying Gold Exchange Traded Funds

Diversification Only;
Should you invest?

Arguments for:

1. Gold is always in high demand, a standardized commodity, very marketable and **portable**.
2. Owning gold can protect you from inflation or currency fluctuations?
3. Diversification of ones portfolio is a legitimate reason to own gold (< than or equal to 8 percent).
4. Gold is an excellent vehicle for protecting wealth over a long period of time?
5. During a period of civil unrest it is an easy way to conceal wealth

But the supply of gold is not ‘limited’ and inflation can cause old and new mines to start back into operation. Moreover, there is plenty of hidden gold in old safes, jewelry, Fort Knox, state gold reserves etc.

Take the example of Silver.

Silver, Platinum and Palladium are also sold as commodities with futures and exchange traded funds: there are daily ‘spot gold, silver and platinum prices’ that reflect active trading in the futures markets

Gold is a protection from economic collapse: high of 1800 and gold spot prices currently around 12-1300 dollars per ounce

* If you take physical possession of the gold, you are not required to pay sales tax in the State of Ohio. The dealers charge between 3 and 8 percent commission

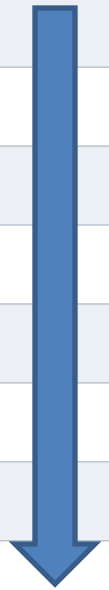
* To document gold content is not easy and many pieces are gold or silver plated

If you have gold items to sell, the dealers will usually offer you an amount based entirely on gold content and not rarity. There are some exceptions in antique gold pieces and Pandas from China.

Some Basic Structural and Chemical Properties of Gem Stones

The Mohs Hardness Scale

Mineral	Chemical Composition	Hardness
Talc	$Mg_3Si_4O_{10}(OH)_2$	1 soft
Gypsum	$CaSO_4$	2
Calcite	$CaCO_3$	3
Fluorite	CaF_2	4
Apatite	$3\,Ca_3(PO_4)_2 \bullet CaF_2$	5
Feldspar	$K_2Al_2Si_6O_{16}$	6
Quartz	SiO_2	7
Topaz	$Al_2SiO_4F_2$	8
Corundum (ruby, sapphire)	Al_2O_3	9
Diamond	C	10 hard



To give you a further frame of reference and understand what will **scratch** what:

On the **Mohs scale:**

The Fingernail is 2.5

The Copper penny is about 3.5

A knife blade, 5.5

Window glass, 6.5

Steel file, 6.5

CHEMICAL COMPOSITION OF GEMSTONES

ELEMENTS

Diamond C

SULPHIDES

Marcasite ..... FeS_2

Pyrite ..... FeS_2

OXIDES & HYDROXIDES

Corundum ..... Al_2O_3

Hematite ..... Fe_2O_3

Opal ..... $SiO_2 \cdot nH_2O$

Quartz ..... SiO_2

Synthetic corundum ..... Al_2O_3

Synthetic rutile ..... TiO_2

Strontium titanate ..... $SrTiO_3$

HALOIDS

Fluorite ..... CaF_2

CARBONATES

Azurite ..... $2CuCO_3Cu(OH)_2$

Calcite ..... $CaCO_3$

Malachite ..... $CuCO_3Cu(OH)_2$

Smithsonite ..... $ZnCO_3$

ALUMINATES

Chrysoberyl ..... $BeAl_2O_4$

Spinel ..... $MgAl_2O_4$

PHOSPHATES

Apatite ..... $Ca_5(F, Cl)(PO_4)_3$

Lazulite ..... $(Fe, Mg)Al_2(OH)_2(PO_4)_2$

Turquois .... $H_5(Al(OH)_2)_6CuOH(PO_4)_4$

Variscite ..... $AlPO_4 \cdot 2H_2O$

SILICATES

Almandite ..... $Fe_3Al_2(SiO_4)3$

Andalusite ..... Al_2SiO_5

Andradite ..... $Ca_3Fe_2(SiO_4)_3$

Axinite ..... $HCa_3Al_2B(SiO_4)_4$

SILICATES, CONT'D.

Benitoite ..... $BaTiSi_3O_9$

Beryl ..... $Be_3Al_2(SiO_3)_6$

Chrysocolla ..... $CuSiO_3 \cdot nH_2O$

Diopside ..... $CaMg(SiO_3)_2$

Dioptase ..... H_2CuSiO_4

Enstatite ..... $MgSiO_3$

Epidote ..... $Ca_2Al_2(AlOH)(SiO_4)_3$

Euclase ..... $Be(AlOH)SiO_4$

Fibrolite ..... Al_2SiO_5

Grossularite ..... $Ca_3Al_2(SiO_4)_3$

Idocrase ..... $Ca_6Al(OH, F)Al_2(SiO_4)_5$

Iolite ..... $(Mg, Fe)_4Al_8(OH)_2(Si_2O_7)_5$

Jadeite ..... $NaAl(SiO_3)_2$

Kyanite ..... Al_2SiO_5

Microcline ..... $KAlSi_3O_8$

Nephrite ..... $CaMg_5(OH)_2(Si_4O_{11})_2$

Orthoclase ..... $KAlSi_3O_8$

Peridot ..... $(Mg, Fe)_2SiO_4$

Phenakite ..... Be_2SiO_4

Prehnite ..... $H_2Ca_2Al_2(SiO_4)_3$

Pyrope ..... $Mg_3Al_2(SiO_4)_3$

Rhodonite ..... $Mn_2(SiO_3)_2$

Serpentine ..... $H_4Mg_3Si_2O_9$

Sodalite ..... $Na_4Al_2(Al, Cl)(SiO_4)_3$

Spessartite ..... $Mn_3Al_2(SiO_4)_3$

Sphene ..... $CaTiSiO_5$

Spodumene ..... $LiAl(SiO_3)_2$

Synthetic emerald ..... $Be_3Al_2(SiO_3)_6$

Topaz ..... $Al_2(F, OH)_2SiO_4$

Tourmaline .. a very complex silicate of boron, aluminum and several other metals.

Willemite ..... Zn_2SiO_4

Zircon ..... $ZrSiO_4$

CHEMICAL COMPOSITION OF GEMSTONES

THE COLOURS OF GEMSTONES ARE AFFECTED BY DIFFERENCES IN CHEMICAL AND ATOMIC STRUCTURE, LEADING TO THE ABSORPTION OF DIFFERENT WAVELENGTHS OF LIGHT. THEIR HARDNESS IS MEASURED ON THE MOHS SCALE, WHICH RUNS FROM 1-10.

ALEXANDRITE

Al_2BeO_4

Hardness: 8.5

Colour caused by chromium ions replacing aluminium in some sites. Colour varies in different light.

AMETHYST

SiO_2

Hardness: 7.0

Colour caused by irradiation of iron 3+ ions in place of silicon in some locations in the structure.

AQUAMARINE

$Be_3Al_2(SiO_3)_6$

Hardness: 7.5-8.0

Colour caused by iron 2+/3+ ions replacing aluminium ions in some locations in the structure.

DIAMOND

C

Hardness: 10

Colourless; can be faintly coloured by the trapping of nitrogen atoms in the crystal.

EMERALD

$Be_3Al_2(SiO_3)_6$

Hardness: 7.5-8.0

Colour caused by chromium ions replacing aluminium in some locations in the structure.

GARNET

$Mg_3Al_2(SiO_4)_3$

Hardness: 6.5-7.5

Colour caused by iron 2+ ions replacing magnesium ions in some locations in the structure.

OPAL

$SiO_2 \cdot nH_2O$

Hardness: 5.5-6.0

A 'play of colours' caused by interference & diffraction of light passing through the structure.

PEARL

$CaCO_3$

Hardness: 2.5-4.5

Produced in the soft tissue of shelled molluscs. Most modern pearls are artificially cultured.

PERIDOT

Mg_2SiO_4

Hardness: 6.5-7.0

Colour caused by iron 2+ ions replacing magnesium ions in some locations in the structure.

RUBY

Al_2O_3

Hardness: 9.0

Colour caused by chromium ions replacing aluminium ions in some locations in the structure.

SAPPHIRE

Al_2O_3

Hardness: 9.0

Colour caused by titanium and iron ions replacing aluminium ions in some locations in the structure.

SPINEL

$MgAl_2O_4$

Hardness: 7.5-8.0

A variety of colours are possible, caused by impurities such as iron, chromium and nickel.

TOPAZ

$Al_2SiO_4(F,OH)_2$

Hardness: 8.0

Pure topaz is colourless; blue & brown varieties are caused by imperfections in atomic structure.

TOURMALINE

$Na_3Li_2Al_6(BO_3)_3(SiO_3)_6F_4$

Hardness: 7.0-7.5

Colour caused by manganese ions replacing lithium and aluminium ions in some sites.

TURQUOISE

$Al_6(PO_4)_4(OH)_8 \cdot 4H_2O$

Hardness: 5.0-6.0

Colour caused by the presence of copper ions coordinated to the hydroxide ions and water.

ZIRCON

$ZrSiO_4$

Hardness: 7.5

A range of possible colours that depend on the impurities present. Colourless specimens are popular diamond substitutes.

- In gem stones there is a differences between *hardness, toughness, durability, cleavage and cracking*

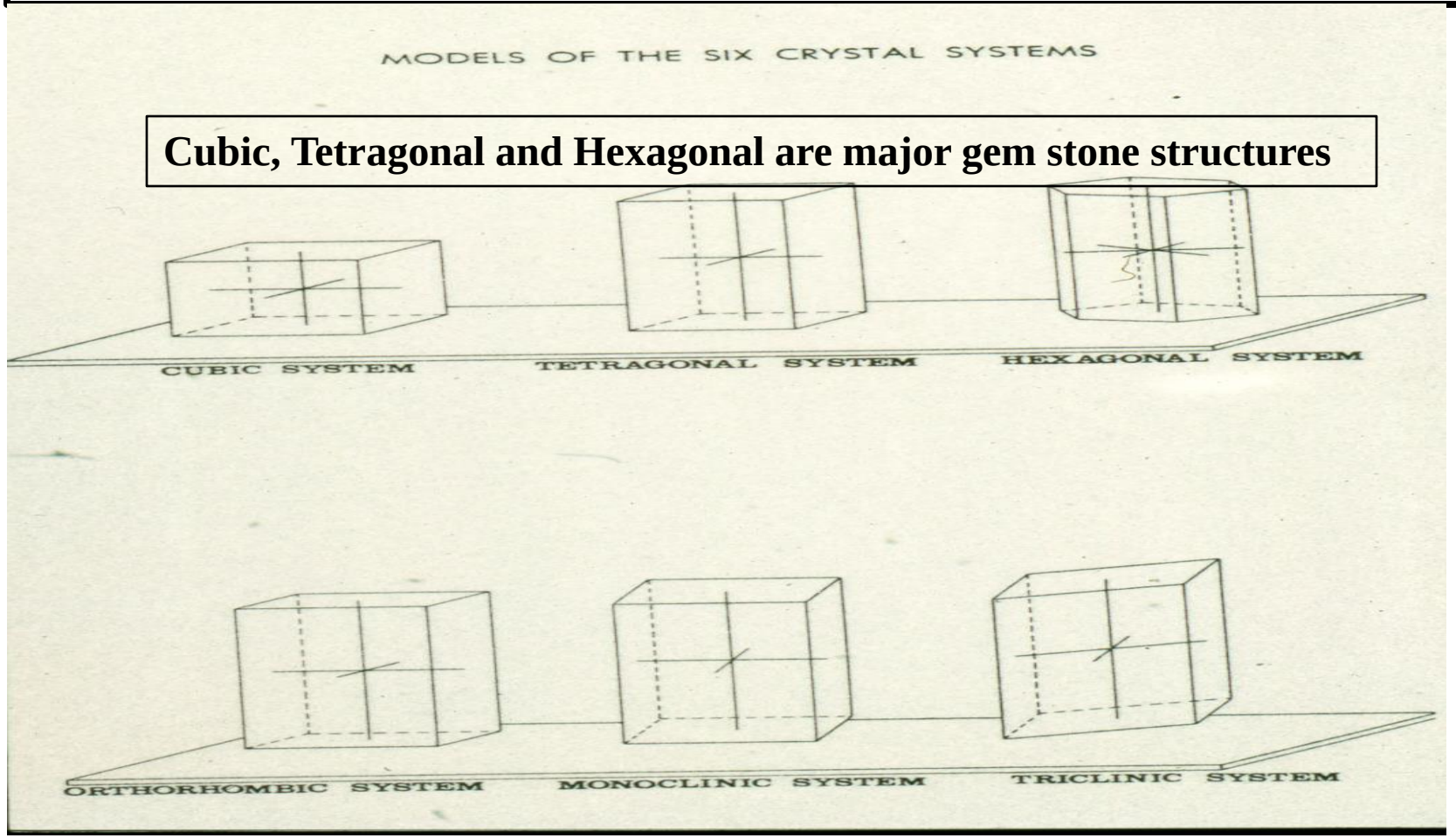
  As examples:

  ***Sapphire** is hard and durable (good finger ring)

  ***Opal** is brittle and often thin, dries out and fine opal is better worn as a pendant

  ***Jade** is tough and fibrous but only 6 on the Mohs scale.

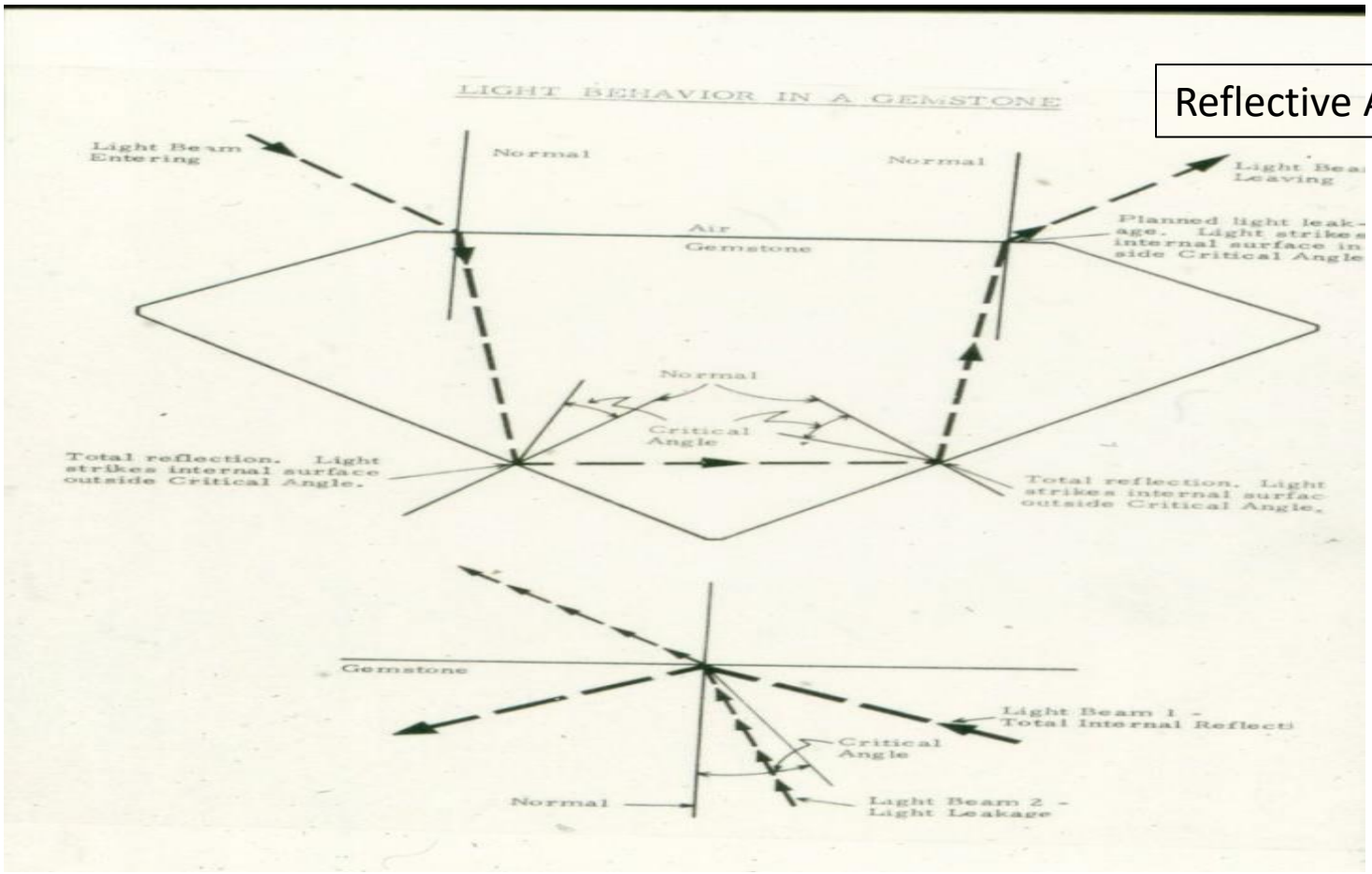
The Six Basic Crystalline Forms in Gemstones



Three Most Common Crystalline Types in Gemstones

- **Cubic crystals** include diamond, garnet, spinel and lapis lazuli
- **Tetragonal Crystals** *include Zircon*
- *Major category* **Hexagonal Crystals** include Aquamarine, Emerald, Amethyst, Citrine (Quartz), Ruby, Sapphire and Tourmaline

Light Refraction and Refractive Indexes: What makes stones brilliant and sparkly



Reflective Angle

The **refractive index** of a **gemstone** provides the single most important piece of information to a gemologist seeking to identify an unknown stone. It is fairly constant.

- Gems with a higher refractive index tend to show more brilliance, since light is bent at a higher angle when it passes into the material. More light is then reflected back out the crown to the eye, rather than passing straight through the gem.

Specific Gravity

- Used in identification with standards solutions and when stone is placed in the heavy liquids it either float or sinks to help estimate Specific Gravity
- Quartz specific gravity 2.66
- Corundum (sapphire and ruby) is 4.00
- Diamond is 3.52
- Zircon, one of the densest of all gemstones, may have a specific gravity as high as **4.73**

Polarization of Light; Test with a Polariscopic

- 1. The stone appears dark throughout a 360° rotation. The stone is isotropic (single refractive and cubic in crystalline structure).
- 2. Throughout a 360° rotation the stone blinks four times, light and dark. The stone is anisotropic (double refractive).
- 3. The stone will appear light all the time. The stone is a microcrystalline or cryptocrystalline aggregate (like, for instance, chalcedony).

Heat Treatment, Magnetism, Grit and Feel

- Turquois, emerald, garnet, quartz, peridot, zircon, tourmaline and topaz are likely to crack if heated to high temperatures.
- Amethyst, aquamarine, zircon, tourmaline, topaz, tanzanite, sapphire may change color when heat treated.
- Magnetite, hematite, tourmaline and many more are magnetic
- Pearls are gritty
- Jade feels greasy

Birefringence, Pleochroism and Play of Colors

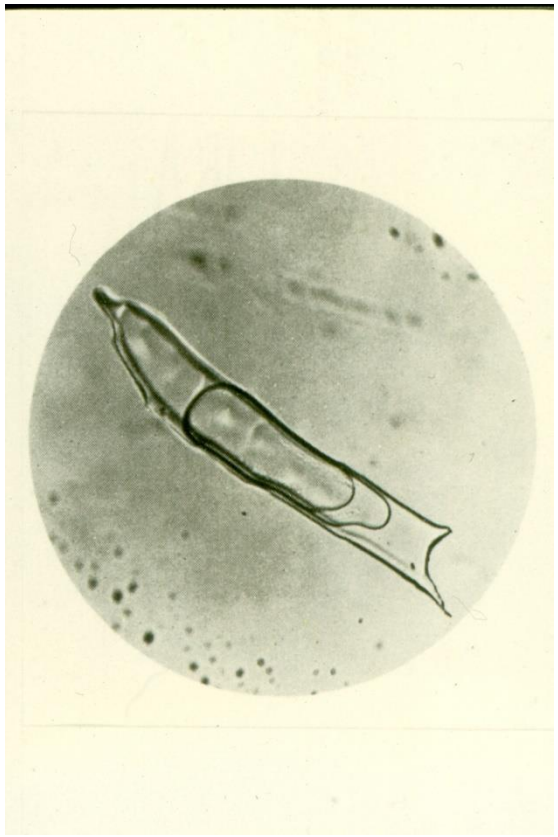
- Pleochroism is caused by differing absorption of light rays in doubly refractive crystals; may be **dichroic** as in ruby that typically is orangey red and bluish red; or **trichroic** such as tanzanite.
- Play of Colors in opals
- A Dichroscope is used to show separate polarized beams and identify certain stones such as emerald.

Color is imparted to most gem stones by impurities (basic minerals colorless)

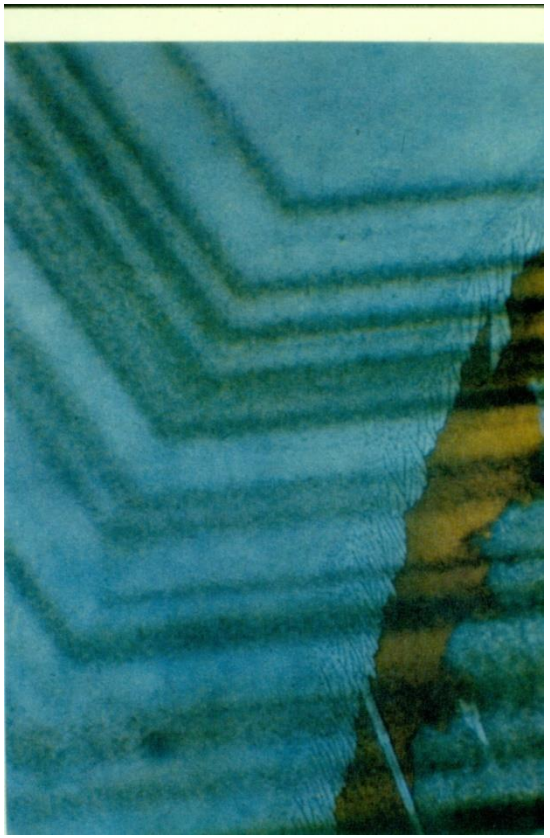
- Idiochromatic—turquois, peridot and malachite (the material itself imparts color)
- Sapphire colored with iron and titanium
- Ruby with Chromium
- Amethyst with Iron
- Emerald with Chromium and some vanadium
- Tourmaline with iron and magnesium

Inclusions

Beryl/Columbian Emerald



Hexagonal; Sapphire



A Lapidary is an expert cutter or engraver of gemstones

- Gem cutters carefully study and fashion their rough stones into finished goods to both maximize brilliance and weight because cost per carat generally rises as stones are larger.
- Many varieties of cuts and carat sizes to accommodate the shape of jewelry pieces. (melee, baguettes, quarters, thirds etc)
- Most fine gems are faceted
- If cut differently from the standard, gems have the term “modified” added to their names. For example, “modified round brilliant” or “modified emerald cut.”
- Gems cut in the brilliant style are always called brilliant cuts (for example, “round brilliant”), while gem cuts in the step style generally have specific names attached to them for example emerald cut, pear shape, marquise etc.

Cabochons, polished face and flat back; occasionally a Cab has an unpolished face and is called a drusy cab

a gem polished but not faceted.

COLORED STONES

The Three Major Colored Precious Stones

*Rubies

*Sapphires

*Emeralds

Unlike Diamonds there is a Greater Variation in quality of colored stones and no easy standards for grading colored stones (use a scale of 1-10?, gage color, clarity, and cut?, factor in zoning, windows and brilliance?, or use general terms such as good, fine, gem quality etc) Thus, for the customer and the jeweler alike, the intrinsic value of a colored stone is more complicated and difficult to ascertain. All prices are somewhat arbitrary and the per carat estimates that I will list for certain stones are just 'what the price has been selling for in the market'. In most jewelry stores, the marked price relates to the price the jeweler paid for the stone or piece of jewelry. Some he may have on considnment.

+ Even the trained-eye cannot retain color (a million hues); you need color standards and familiar or uniform lighting in which to compare stones.

+ Keep a range of comparison stones at your store and make major colored stones purchases only after you have evaluated them in a familiar setting

Physical and Chemical Properties of Rubies and Sapphires

- Both are corundum (aluminum oxide or Al_2O_3) which is a colorless mineral
- Hexagonal system (six sided crystals)
- Hardness 9 and toughness excellent
- Inclusions include “silk” or rutile needles that can produce a “six legged star”
- Burma rubies strongly fluoresce
- Pink sapphire name for light colors of red

Sapphires

- Can be and often are larger stones and price does not appreciate that much with size.
- Titanium and iron oxide impurities produce blue sapphires
- Birth Stone for September
- Many colors; yellow, Padparadsha or hyacinth (very valuable), brown, violet, green, pink.
- Look at in a variety of light sources to assess beauty and degree of inkiness (in the jewelry store they are shown with florescent lighting)

Origins and differences between blue sapphire; subtle differences between origins.

Kashmir-cornflower blue and appear sleepy

Burma, Thailand, Cambodia

Sri Lankan—lively and brilliant

Montana and Australia and many countries

Burma and Ceylon Stones

Sleepy cornflower blue:
2 carat fine-
$5,000/carat

Lively and slightly lighter stone from Sri Lanka: fine 2 carat stone-$3,500 per carat

Padparadash Sapphire: 2 carat fine-$4,500 per carat

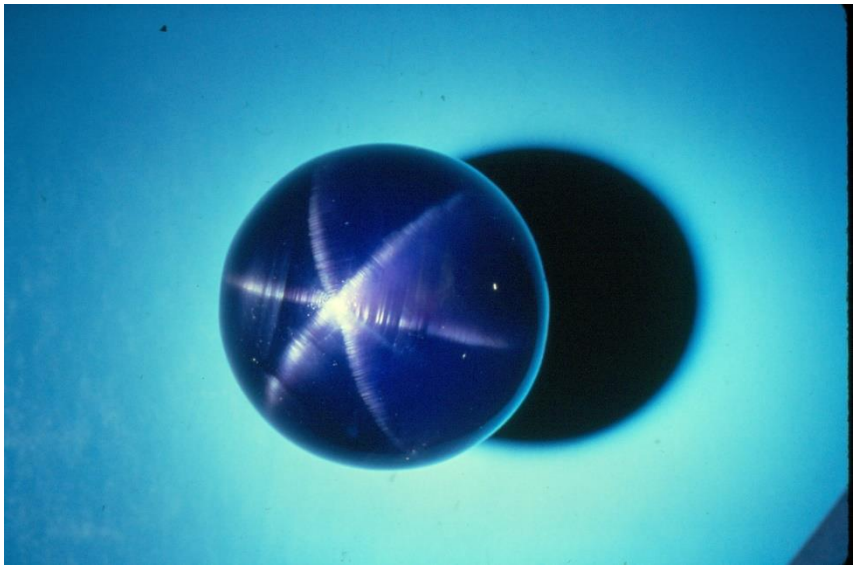
Sapphire

Comes in Many COLORS and shades

Synthetic Alexandrite; two colors amethyst to pale blue is synthetic sapphire

Both the same ‘colorless’ mineral

Star Sapphire: 2 carat fine- $1,200/ per carat



Star Ruby: 2 carat $1,700/carat

Sapphire Treatments

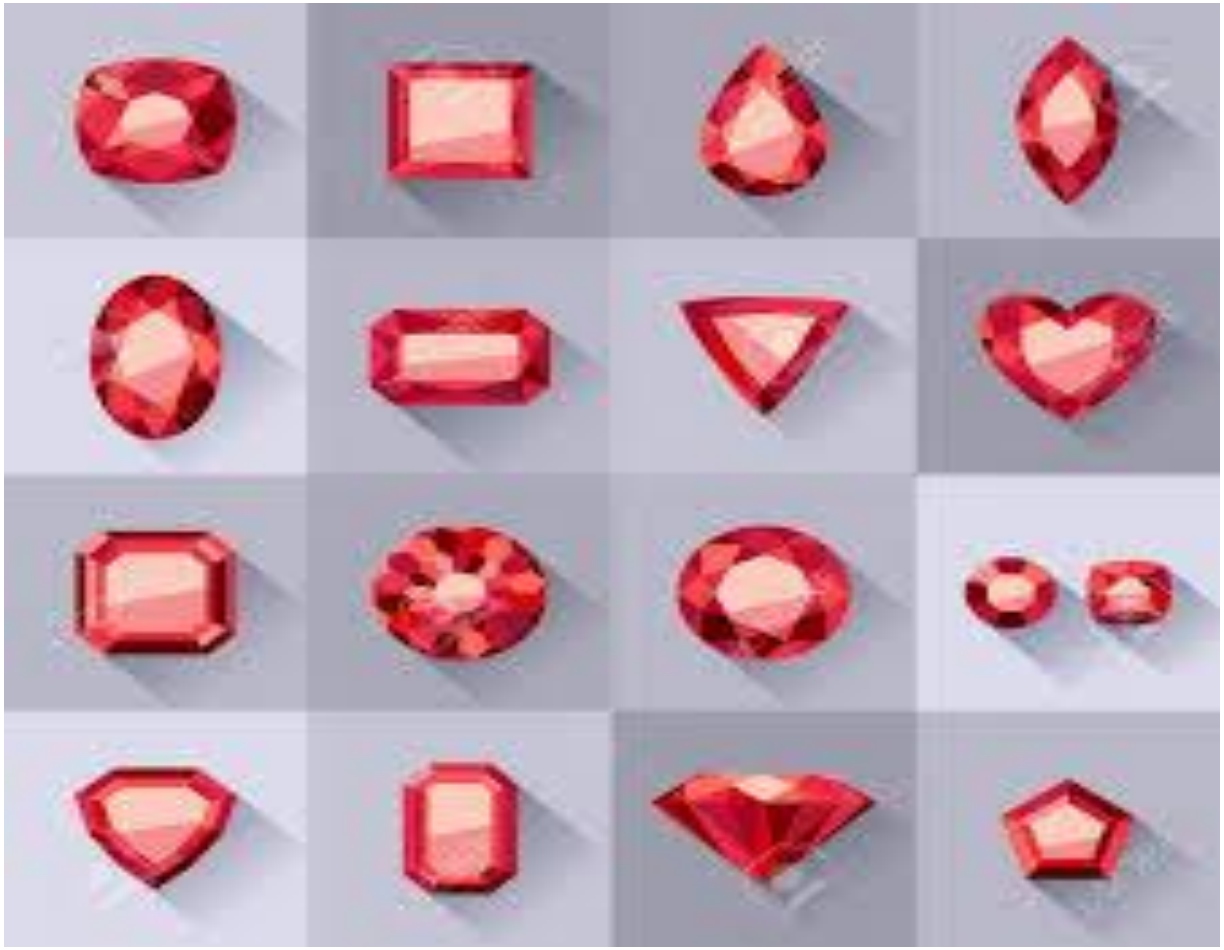
- Less translucent and darker sapphires that look ‘inky’ fashioned as cabochons
- Synthetics sapphire made by flame fusion technique and is manufactured in bulk
- Heat-treated (majority of high quality stones)
- Beryllium diffusion treated--permanent

(very hard to differentiate treated stones from untreated stones even for an expert)

Rubies

- Large rubies a rarity—very few gem quality stones over 5 carats
- Birth Stone for July
- Chromium oxide impurity

- General Types;
- 1. Burma—pigeon blood (2carat-$25,000/carat)
- 2. Sri Lanka--Rasberry
- 3. Thailand



Rubies; cuts, sizes, differentiate from pink sapphire
No standard cut

Burma Ruby

Strong Florescence under ultraviolet light:

Ruby Treatments

- Synthetic ruby can be created by several different methods including flame fusion and others. **Rubies are also subjected to more treatments than almost any other gem.**
- Most all are heat treated and this is undetectable and does not effect price much.
- Command higher prices than blue sapphire

Emerald

Color Produced by Chromium Oxide impurity

The very best and most valuable come from Columbia (Muzo & Chivor mines)

Distinguish from Green Beryl (Brazilian mainly)

African goods (more iron, darker)

High degree of imperfection; look under the prongs

Beryl: $Be_3Al_2Si_6O_{18}$

Emeralds

Aquamarine; iron: 3 carat-fine-$375/carat

Morganite;lithium: 3 carat-fine- $125/carat

The Paradox of Aquamarine; the bathtub effect; just because it is larger does not mean that it is more valuable. Intense smaller blue stones are highly valued

Beryl

There is a differences in color intensity between Green Beryl (Brazil) and Emerald.

Aquamarine

Manganite

Golden Beryl

Emeralds: care, treatments and synthetics

1. Mechanical Cleaning is not recommended for emeralds. (Ultrasonic, steam, and boiling methods can shatter emeralds)
2. Oiling to improve color is a common practice
3. Synthetics are expensive and hard to separate from natural since manufacturers can add inclusions : Emerald-- Chatham, Gilson, Linde, Russian synthetic, Emerald Hydrothermal.
4. Emeralds almost always has inclusions that are tip offs to authenticity

Other Colored Stones

Quartz; most common mineral in earth's crust: colorless, SiO_2: sand in crystalline form

- Most common semi-precious gem stone used in jewelry and comes in many colors
- Citrine, Amethyst and Rose Quartz most common.
- Smoky Quartz, Aventurine (green)
- Brownish Tiger's eye, Greyish Cat's eye
- Geodes as source of quartz crystals
- Inexpensive

Crystalline Quartz; most common mineral in earth's crust: hexagonal, colorless (rock crystal, most a

Citrine

November Birthstone

Amethyst Quartz

February Birth stone

Geodes are a favorite of rock hounds

6 carat fine stone-$45 per carat

Chalcedony/ Cryptocrystalline Quartz The Rock Hound's Quarry

- Comes in all colors, color banding and is translucent
- Agate, Plasma, Moss Agate, Bloodstone, Carnelian, Chrysoprase, Onyx, Petrified Wood
- Jasper a catch all term for opaque, colored chalcedony

Pictures of Chalcedony

Chrysoprase, Carnelian, Agate

Onyx commonly carved as in chess sets etc.

Black onyx with Coral

Finest Men's Ring

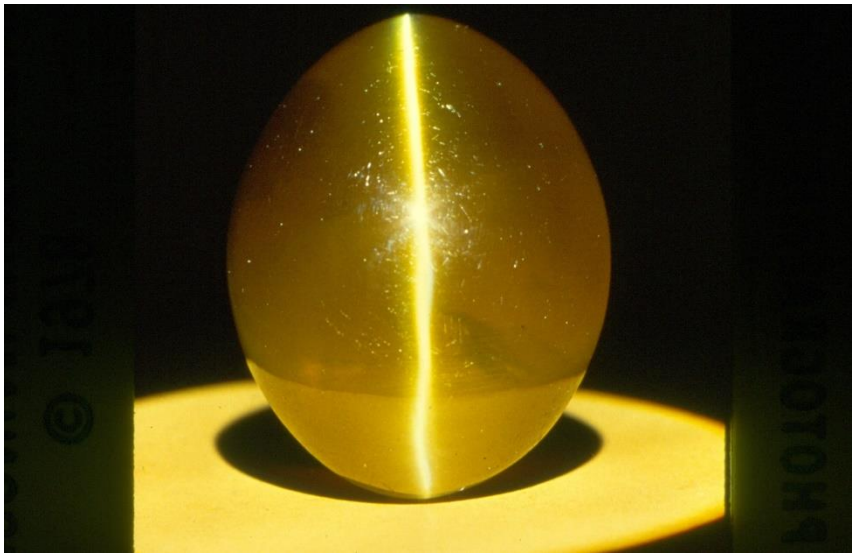
Chrysoberyl

Alexandrite has a change in color from red or violet to green and blue depending on light source.

Chrysoberyl Cat's Eye(milk and honey—it winks)

Chrysoberyl Cat's Eye

Best Man's Ring: milk and honey eye that winks



Better than a star sapphire or diamond

The Real Alexandrite Article

Alexandrite is a unique stone; fine varieties change color with green and reddish violet depending upon the light .

Synthetic corundum sold as an affordable Alexandrite substitute and is very common in lady's rings

Hematite; Iron Oxide, occasionally brownish red streaks. Can be stamped or molded

Malachite (copper ore) and Pyrite (fools gold)

Rhodochrosite & Rhodonite Cabochon and Beads and Carvings

Amber, Choral, Ivory, Jet & Tortoise shell

Peridot: Attractive, Affordable, unique yellowish-green and Durable

Soft velvety appearance, 6-7 on Mohs scale, August birthstone, and gem quality mostly come from the middle east: 5 carat fine-$235 per carat

Spodumene: **Kunzite**; often big stones

Beautiful pink stones like Morganite

The Feldspar Group: Moonstone, Labradorite, Amazonite, Sunstone

Moonstone

Amazonite

Labradorite

Pearls

- Layers of nacre, calcium carbonate
- Orient and body color
- Various colors; pink, white, cream, black
- South sea island pearls; white, greyish, black (Australia)
- Many shapes; round, pear, drop, button, baroque,
- Blister pearls
- Biwa and fresh water pearls
- Natural vs. cultured
- Value based on size, shape, luster, uniformity
- Delicate; hardness 2 and a half, acid will dissolve

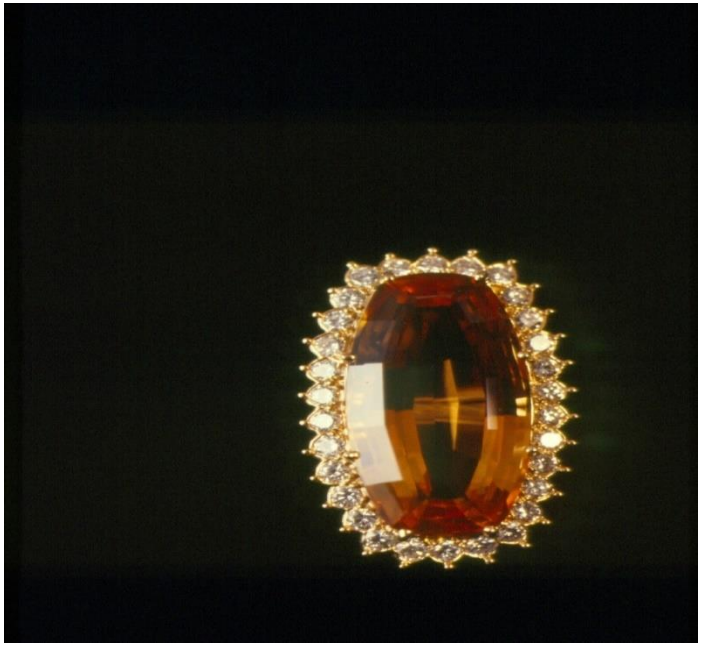
Pearls; a challenge to evaluate and deteriorate over time

Black pearl

Cultured Pearls

Blue Topaz; an excellent substitute for Aqua Marine. Topaz can be many colors including red!, pink (heat treated) and yellow

Precious topaz



Blue Topaz

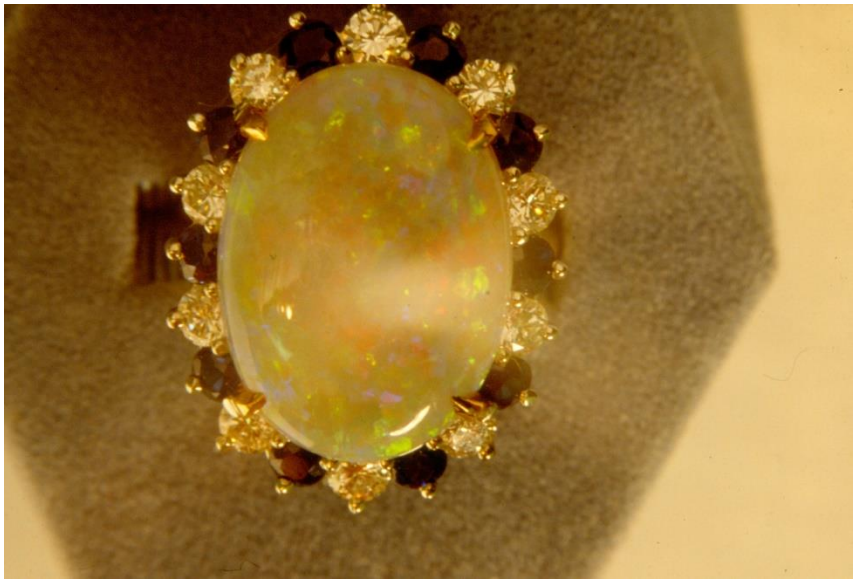
1. Inexpensive
2. Abundant Usually irradiated to increase color
3. Eight on the Mohs scale
4. Has a hard look unlike Aquamarine
5. November birth stone

Fine 10 carat stone-$15 per carat

Opals—Play of Color: Four basic plays; Pinfire, Harlequin, Flame and Flash with order of desirable colors-red, violet, orange, yellow, green and blue

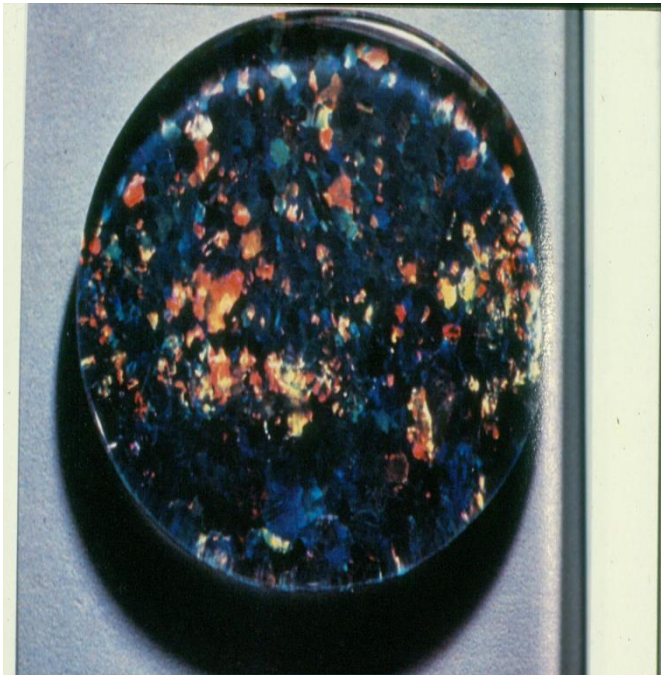
Black Opal

5-5&1/2 on Mohs scale and matrix determines if black or white, best in pendants rather than rings

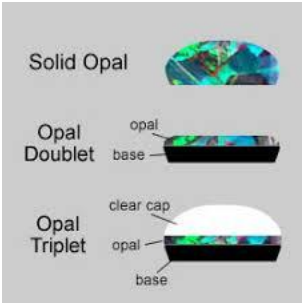


Problem with thin backing and dehydration with cracking.
Unfavorable mythology of bad luck

Black Opal: Black or Dark Matrix with a play of colors with blue and green being less valuable than violet, orange and red; the more colors and uniformity the more valuable the stone.



Opal Doublets and Triplets; Fine **thick** opal is rare and blacks are very expensive



Mexican Fire and Water Opal

Jadeite and Nephrite Jade

Comes in many colors:

Mutton fat

Green apple (cheap nephrite)

Purple Jade is very valuable but often treated and this alteration is difficult to test for.

Extremely tough, fibrous and good for carving, hardness 6-6+

Imperial Jade

Very prized by Chinese Dynasties,

Usually fashioned as cabochon

Turquoise(Copper Aluminum Phosphate) Versatile and inexpensive

Persian Turquois, Dense, nonporous and takes high polish

More Common Varieties

American or Mexican

Turquois Matrix

Spider web

Garnet; (the garnet group) several species or a group that vary chemically

Almandine garnet; the typical color in estate pieces

Pyrope &Rhodolite garnet

Garnet comes in every color except blue and thus makes for a good January birth stone with a hardness of 7-7.5

Yellow and Green Garnet

Grossularite Garnet

Dermatoid or Green Garnet (pricey)

Tourmaline

Attractive Green stones that are the affordable substitute for Emeralds

Also have Watermelon Tourmaline

And Pink Tourmaline

Hard and durable and good as finger rings

Typical fine green stone; chrome tourmaline: 3 carat fine stone-$575 per carat

Watermelon

Lapis lazuli

Intense blue, lazurlite with white (calcite) and yellow (pyrite) inclusions

Fine quality from Afghanistan

Great for carvings, necklaces and bracelets

Tanzanite

Comes out of the ground colorless; used to come from a single mine in Tanzania but now quite common and inexpensive.

It is a tricolor stone that rivals fine sapphire

5 carat fine stone-$500 per carat;1 carat $350

Zircon (Zirconium Silicate) heat treated, multicolored, high refractive index and faceted like diamonds; hard but minute fractures

- High Refractive Index; diamond substitute.

Can be any color

Fine Blue Zircon:
fine 3 carat stone $150 per carat

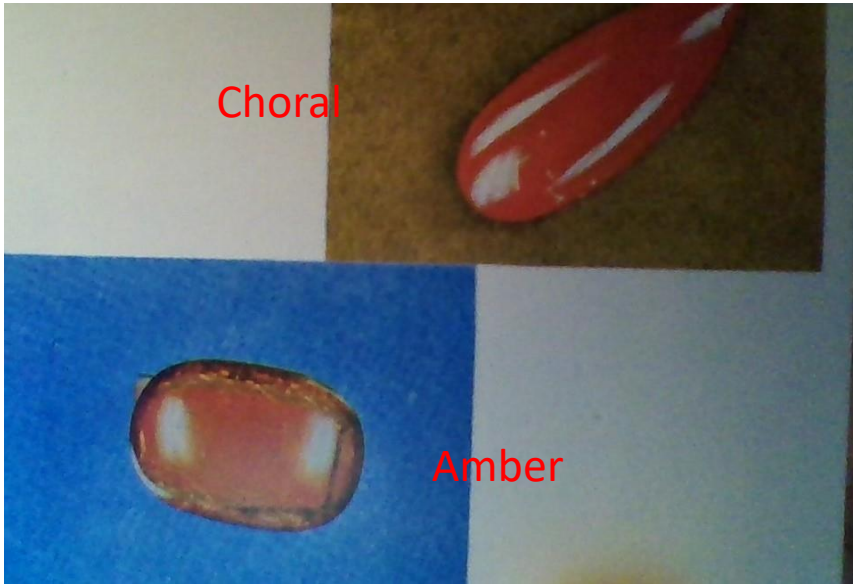
Red Spinel can compete with fine ruby; orangey red is the most valuable, but many colors

Synthetic spinel used to imitate a range of other gems.

Organic Gems

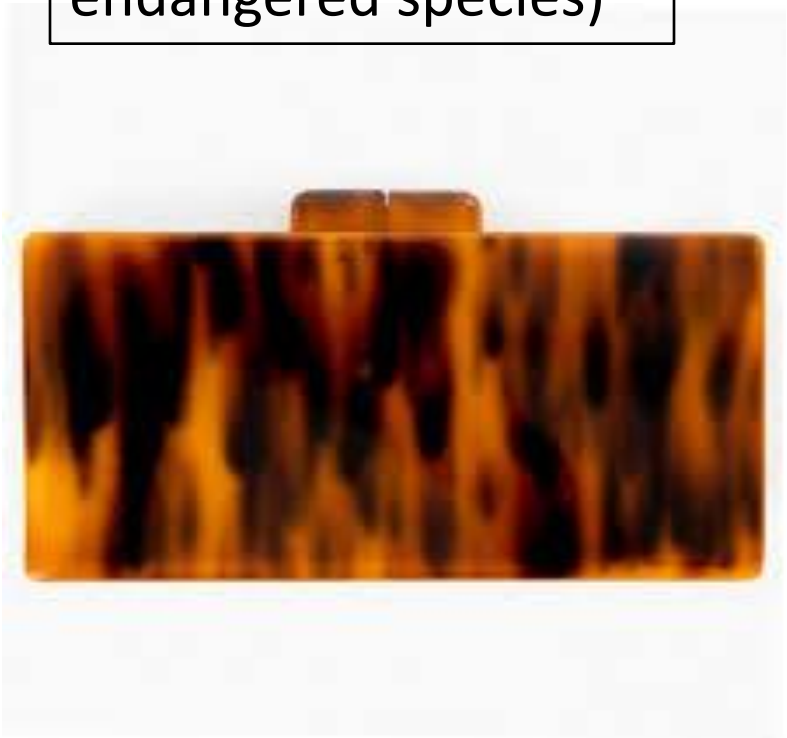
Often Carved and free form

- Tortise Shell
- Ivory
- Jet
- Amber
- Coral



More Organics

Hawksbill Tortoise (an endangered species)



Ivory Carving

Black Stones

Black Diamond

Diopside Star

Obsidian (volcanic glass)

Variety of minerals that are faceted for jewelry

Some other faceted rarer gems

- Andalusite
- Appatite
- Benitoite
- Calcite
- Diopside
- Euclase
- Florite
- Iolite
- Kornerupine
- Scapolite
- Serpentine
- Sphene
- Thomsonite
- Wulfenite

Artificially made stones; Goldstone is glass with copper crystals.

Many imitations and types and colors of glass

Glass (PASTE)

- CRYSTAL—generally lead glass; lead content of between 25 and 50 percent. Lead increase the refractive index but decreases hardness
- Enamel—glass fused to metal
- Faience—any kind of glass glaze on pottery
- Rhinestones---colorless glass
- Apache Tears---volcanic glass consisting of rounded pebbles of black obsidian

Plastic Imitations

- Many types of plastics: celluloid, Bakelite, cellulose acetate, acrylic resin, melamine, urea resin and galalith
- Thermoplastic and Thermosetting
- Distinguished by feel, weight, smell, and molding characteristics.
- Rarely faceted
- Molded interfaces

Common Plastic Imitations

- Coral, pearl, onyx, moonstone, cat's eye, shell, amber, tortoise shell, ivory, and other organic materials.
- Basically, costume jewelry

Carved and Engraved Gems

- Cameos from shell and onyx with two different color layers
- Pottery cameos (Wedgewood)
- Intaglio/engraving from hard stone ideal for a man's ring
- Scarabs beetle forms
- Jadeite and nephrite carvings
- Onyx, carnelian, agate, and other chalcedonies are most commonly carved as well as lapis-lazuli and rock crystal.

Carved and Engraved

Cameo (conch shell)

Scarab

Enamels in Jewelry: glass

- Cloisonné; enamel confined to cells; gold, silver and copper backing.
- Plique-a-Jour; lacks a metal back; stained glass windows
- Champlevé; engraved metal backing
- An art form with many twists with brilliant results in ornamentation of jewelry

Estate/Antique/Vintage Jewelry

- Evaluate like any other piece of jewelry by breaking it down into its parts. Rarely do you pay a premium for antiquity and you have to differentiate between ‘style’ and ‘fashion’. Broaches, filigree etc.
- Estate jewelry in the local store is usually on consignment and the jeweler has less room to barter.
- The dealer in New York probably bought a sizeable estate for cash at 10 cents on the dollar. The auction houses are the enemy of the dealer.
- In the trade if you pay in cash you automatically get a 10 percent discount. Many transactions are under the table.

Auction Houses

- Few dedicated auction houses locally but EBTH and Cowan's deal with jewelry
- Nationally there are many major auction houses including Bonham, Christie's and Southeby.
- Most jewelers will buy from privates and you can get easily get offers for beautiful pieces or have them sold on consignment.
- Each auction house has different ground rules concerning commissions, reserves and type of goods they auction. The more important the piece, the greater interest they have.

Buying over the Internet

- Should have a basic knowledge about what you are buying and consider only those items that have adequate descriptions.
- Certificate documentation for diamonds
- Try to check on the reliability of the seller
- You can find most anything on the internet and many items you can bid for.

Selling on the Internet

- Tedious and photographing jewelry is difficult
- Takes a good bit of time and patience
- Transactional costs of packaging and shipping
- Managing returns and your reputation
- **Best advice, keep your day job**.

Web sites to buy and sell jewelry; I have no first hand experience

- **Etsy.**
- **eBay.**
- **Art Fire.**
- **Bonanza.**
- **Zibbet**

Where to buy locally

- For average jewelry, I would suggest Sam's Club or Costco as their markups are reasonable and uniform. Disadvantage is that you cannot negotiate the fixed price and salesperson rarely knows much about the merchandise.
- I do not recommend Mall shopping.
- It is good to establish a relationship with a local reputable jewelry store that is fair, guarantees the merchandise and is a resource for repair work.

The Appraisal Game

- Often a typical jewelry appraisal is brief and not very descriptive with ambiguous terms. This may be intentional for insurance purposes and to allays any buyer's remorse so as to reinforce the feeling that the buyer has gotten a really good deal.
- Insurance coverage is quite expensive and runs about $11 dollars per year for $1000 coverage. Thus an inflated appraisal value will be wasteful.

How does the jeweler and insurance company make out like bandits' from a vaguely written appraisal?

If you were to lose your engagement ring diamond that was insured for $4,500 at double or triple key, the jewelry store would replace it at their 'replacement cost' that would be $1,500 or if they replace it with a lower quality stone that was justified because the appraisal was poorly defined, it might be as low as $1000. The insurance company might pay the jeweler $2,500 rather than the $4500 of coverage you had been paying for. Thus the jeweler made $1500 and the insurance company avoided paying the full $4500 in coverage on the deal.

Some Practical Solutions

- Insist on a certificate or very descriptive appraisal.
- Ask a gemologist for a cost plus 20 percent appraisal that was based on the jeweler's or wholesale replacement cost.
- Keep you fine diamonds and colored stones in a secure safe and replace the diamonds with matching CZs or colored fakes in the jewelry pieces that you wear on a regular basis.
- Have two appraisals and use the lowest and best defined for insurance purposes.

More Ideas

- Valuable ear rings are more likely to be lost and be sure to list them on your insurance.
- The center stone on finger rings is most vulnerable to displacement; insure it.
- Have the prongs and clasps on valuable jewelry that you wear often checked yearly
- Make a detailed list of all your fine jewelry that is stored for safe keeping.
- Enjoy your treasures and periodically clean it.
- Establish a trusting longer-term relationship with a reputable jeweler that is knowledgeable and guarantees the quality of his products.

Lapidary Societies

- **Lapidary clubs** promote popular interest and education in **lapidary**, the craft of working, forming and finishing stone, minerals and gemstones. These **clubs** sponsor and provide means for their members to engage in all forms of jewelery making, cabochon cutting and faceting, carving, glass bead making and craft work.

Societies for geologists, rock hounds and archeologists

- Rocktumber.com
- Rings-things.com
- Dozens of clubs that sponsor trips to hunt for gems.

If you should want a complete file of the slides for this course, email me at rgwendel4@gmail.com and I will sent you the file. This course has been instrumental in renewing my interest in gemology and giving me a sense as to if I should continue to again give a course in gemology, jewelry and the jewelry business.