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Gemstones

A gemstone is a piece of "mineral", which has a crystal structure, and has been cut and polished to make jewelry or an ornament. However some stones which are classified as gemstones are probably not a mineral! For example, opal has an amorphous structure and lacks a definitive chemical formula while amber is organic in origin.

The Ancient Greeks, divided gemstones into precious stones and semi-precious stones. *Diamond*, *ruby*, *sapphire* and *emerald* are categorized in the precious stone category while all others are semi-precious.

The terms precious and semi-precious are also deceiving as it implies that the precious stone's commercial value is higher than semi-precious. However, it is not the case, rather, the terms originate from ancient times and refer to the rarity of the gemstone.

Most precious stones are translucent with fine colours in their purest forms, with the exception of colourless diamond which is transparent. Translucent stones are very scarce but they are also hard with a hardness of 7.5 — 10 on the Mohs scale (Mohs hardness scale ranges from 1 — 10 with 10 being the hardest defined by diamond).

Top to bottom: Sapphire, emerald, diamond and ruby.
上至下：鑽石、紅寶石、藍寶石及祖母綠

The aesthetic value is one of the major factors that affects the value of these stones. Since gems are used as jewelry or ornaments, they have to look colourful and eye-catching where transparency, colour, and reflective index are big factors in their attractiveness. Gems are seldom opaque, but usually are transparent to translucent. Colours can range from black to white and any colour within the rainbow. Refractive index determines how light travels within the stone and affects how much it sparkles.

Like diamond, gemstones are valued by 4Cs—carat, colour, clarity, and cut. Each carat is 200mg (0.2g). Colour is usually better when the stone is more vivid. Clarity depends on inclusions and whether there are any flaws or cracks. And finally, cutting enhances the optical properties of the gemstone giving it the sparkling feature.

Classification

Gemstones can be categorized into different groups under their chemical formula. Below are some commonly seen gemstones categorized according to their chemical formula.

寶石

寶石是一塊具有晶體結構的“礦物”，可以經切割及打磨來製造珠寶及飾物。雖然如此，亦有一部份歸類為寶石的可能並非礦物。例如：蛋白石屬於非晶體結構，而且沒有特定的化學式；琥珀本質上則為有機物質。

古希臘人將寶石分類為貴寶石及半寶石。鑽石、紅寶石、藍寶石及祖母綠被歸類為貴寶石，而其他的寶石則歸類為半寶石。貴寶石及半寶石雖只差一字，但卻常令人誤會貴寶石的商業價值高於半寶石。現實情況往往不是這樣，這兩個名字的由來只反映古時不同種類寶石的稀有程度。

大部份的貴寶石在最純淨的狀態下呈半透明及具有漂亮顏色。唯一例外是呈透明的無色鑽石。半透明寶石十分稀有，而且硬度很高，達到摩氏硬度的 7.5-10 (摩氏硬度分為十個等級，硬度 10 被定義為鑽石的硬度，為最高的硬度等級)。

美學價值是決定寶石價值的重要因素。由於寶石主要用於珠寶或飾物，他們需要具有漂亮的色彩以吸引別人目光，所以寶石是否吸引的主要因素取決於它們的透明度、顏色及折射指數。大部份的寶石是呈透明至半透明，只有很少是呈不透明的。顏色方面，由白色的到黑色的都有，亦可以是彩虹顏色上的任何一種顏色。寶石的折射指數決定光線進入寶石內的行走路線，這會影響寶石發出的光澤。

相同於鑽石，寶石也是以 4C 來衡量其價值－即成色、淨度、切工及克拉重量。一克拉 (卡) 為 200 毫克 (0.2 克)；如果寶石的顏色比較鮮艷，其成色一般較高；淨度取決於其內含物，以及是否有裂紋或裂縫；最後，切工可增加寶石的光學特性，令其更加閃爍生輝。

分類

不同寶石可根據其化學式劃分成不同類別。以下為部份常見的寶石，並以其化學式作出分類：

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Beryl — $Be_3Al_2(SiO_3)_6$

Beryl is a beryllium aluminium cyclosilicates mineral. It has a Mohs scale hardness of 7.5—8 and has a hexagonal crystal system.

Aquamarine is a type of beryl with a blue or turquoise colour. The pale blue colour is attributed to iron (II) ions while the golden-yellow colour is attributed to iron (III).

Emerald is another type of green beryl. The colour green comes from chromium and sometimes vanadium.

Corundum — Al_2O_3

Corundum is an aluminum oxide mineral with a Mohs scale hardness of 9. Corundum has a hexagonal crystal system.

Ruby is one type of corundum. It is red in colour due to the presence of chromium.

Sapphire is another type of corundum. Although it is commonly known as blue sapphire due to the presence of iron, sapphire can be yellow, purple, orange, or greenish and these colours are given by elements titanium, chromium, copper and magnesium respectively.

Aquamarine *海藍寶石*

綠柱石 – $Be_3Al_2(SiO_3)_6$

綠柱石為鈹鋁環硅酸鹽。其摩氏硬度為 7.5-8，結構為六方晶系。

*海藍寶石*是綠柱石的一種，呈藍色或青綠色。其淺藍顏色源自鐵(II)離子；其金黃顏色則源自鐵(III)離子。

*祖母綠*是另一類綠柱石，其綠色源自石內的鉻，少數情況則來自釩。

剛玉 – Al_2O_3

剛玉是氧化鋁礦物，摩氏硬度為 9，結構為六方晶系。

*紅寶石*是其中一種剛玉，其紅色源自石內的鉻。

*藍寶石*是另外一類剛玉，雖然因為石內的藍色鐵離子而被稱為藍寶石，但如果石內含有鈦元素，它會呈黃色；如石內含有鉻元素，它會呈紫色；如石內含有銅元素，它會呈橙色；如石內含有鎂元素，則呈綠色。

Quartz — SiO_2

Quartz is the second most abundant mineral in the Earth's continental crust and is a silicate mineral with a hardness of 7 and a hexagonal crystal system. There is a wide variety of quartzes, and several of them are used as gemstones; their differences being based on the macro-crystalline and micro-crystalline structure.

Amethyst is a purple variety of quartz. Its violet colour is because of irradiation, iron (III) impurities and the presence of trace elements of large ionic radius.

Rose quartz is a pink quartz. The presence of titanium, iron, or manganese gives it the pink colour.

Agate is a microcrystalline silica. It often exhibits a banded appearance

Black *onyx* is a black quartz and is one of the most famous varieties of onyx. It is not as common as coloured bands onyx. Most "black onyx" on the market is artificially coloured by dyes.

Jasper is an opaque and impure variety of quartz. It can be red, yellow, brown or green in colour and sometimes blue.

Top Left: Amethyst ring;
Top Right: Rose quartz bracelet;
Bottom Left: Black onyx heart pendant
左上：紫晶戒指； 右上：薔薇手鐲；
左下：心型黑瑪瑙吊墜

石英 – SiO_2

石英是地球大陸地殼上第二豐富的礦物，它是硅化物礦物，摩氏硬度為 7，結構為六方晶系。世上有很多不同種類的石英，其中某些被用作寶石。其中的差異主要在於它們的巨型晶狀結構及微晶狀結構。

*紫晶*為其中一類石英，其紫色是源於光的放射、鐵(III)雜質及石內少量具有大離子半徑的元素。

*薔薇石英*是一種粉紅石英，石內的鈦、鐵及錳令其呈粉紅色。

*瑪瑙*是一微晶狀硅石，它外表經常呈環帶。

*黑縞瑪瑙*是一種黑色石英，亦是其中一種最有名的縞瑪瑙，相比於染色的環帶縞瑪瑙，它較少見。市場上大部份的"黑縞瑪瑙"都是用顏料以人工染色而成的。

*碧玉*是一種不透明及不純淨的石英，它呈紅色、黃色、啡色及綠色，少數情況呈藍色。

Tourmaline — $(Ca,K,Na,[])(Al,Fe,Li,Mg,Mn)_3(Al,Cr,Fe,V)_6(BO_3)_3(Si,Al,B)_6O_{18}(OH,F)_4$

Tourmaline is a crystal boron silicate mineral with Mohs scale hardness 7 — 7.5. Tourmaline has a large group of gemstones as one may see from its chemical formula; this gives tourmaline a wide range of colours with different combination of elements.

Rubellite is a pinkish red variety of tourmaline. The name comes from its ruby-red colour.

Verdelite is a green variety of tourmaline. It is also called

Rubellite *紅碧璽*

電氣石 – $(Ca,K,NA,[])(Al,Fe,Li,Mg,Mn)_3(Al,Cr,Fe,V)_6(BO_3)_3(Si,Al,B)_6O_{18}(OH,F)_4$

電氣石是硼硅酸鹽礦物的晶體，摩氏硬度為 7-7.5，由其化學式可知，有大量的寶石都屬於電氣石類別，它們有不同的顏色，亦由不同元素組成。

*紅碧璽*是一種帶粉紅色的紅色電氣石，其名稱來自其紅色色彩。

*綠碧璽*是一種綠色電氣石。由於與祖母綠的顏色相

emeraldite for its similar green colour to the emerald.

Artificial Treatment

Gemstones are often treated to enhance the colour and clarity of the stone. The ultimate goal is to increase the value.

Heating is commonly adopted to improve colour and clarity. For example, *citrine* is a variety of quartz with a pale yellow to brown colour. However, it is rare in nature, and most commercial citrines are heat-treated amethysts or smoky quartz. The heat changes the oxidation states of the iron within the crystals, thus altering the colour.

Exposing certain stones to **radiation** will change their colour. Radiation changes the atomic structure of the gemstone resulting in the colour change. Blue *topaz* is rare in nature and also one of the most common irradiated gemstones. This is formed by exposing colourless to pale blue colour topaz to radiation.

Other treatments such as **waxing** and **oiling** are also used to enhance the clarity and colour of the stone by coating the surface.

Fracture filling is used to fill in cavities within the gem to greatly enhance the appearance.

Ametrine — a mixture of amethyst and citrine. It is a naturally occurring mineral and can be created by differential heat treatment.
紫黃晶 —紫水晶及黃水晶的混合物。它是一種天然礦物，可以利用差分熱處理製造。

With current technology, most gemstones can be created in the laboratory where synthetic gemstones have the same chemical and physical characteristics as those in nature. For example, diamonds, which is the hardest known material, can be created in labs. Most "manufactured diamonds" are for industrial use as abrasives.

Marketing

The value of a gemstone depends on how much people like the stone. Marketing is a key factor to "promote" its value.

It is very difficult for a layman to justify the qualities of gemstones. Thus, the Gemological Institute of America (GIA), a nonprofit organization, offers gemstone identification and buying advice to consumers and training to those in the jewelry trade.

A GIA inspected gemstone will be provided with a certificate describing its qualities. These certified gemstones are sold at a premium price.

Buying a gemstone which is knowingly "manufactured" or has been "treated" is an interesting dilemma for a buyer. Of course most people would want the natural stone but cost maybe prohibitive. However treated stones can display all the key characteristics of a gemstone and should not be considered of inferior quality because of this.

似，亦被稱為綠輝石．

人工處理

寶石常常會經過處理以加強其顏色及淨度，目的是增加其價值．

加熱處理常用於改善寶石的顏色及淨度．例如，黃水晶是其中一種石英，呈淺黃色至啡色．天然的黃水晶十分罕有，而大部份在市面出售的黃水晶是經加熱處理的紫水晶或煙晶．熱力改變了晶狀結構內的鐵的氧化態，令寶石顏色轉變．

某些寶石外露於**輻射**下會改變其顏色．輻射改變了寶石的原子結構令其顏色改變．藍黃晶在自然界十分稀有，亦是其中一種最普遍的經照射寶石．其製造方法是將透明至淺藍色的黃晶置於輻射下．

其他處理方法包括**注臘**及**浸油**可用作寶石表面的塗料，以改善顏色及淨度．

裂痕填充用以填補寶石內的空穴，可大幅改善其外表．

在現今的科技下，大部份的寶石都可於實驗室內製造，而合成寶石與天然寶石的化學及物理特性是相同的．例如，已知最硬的物質鑽石就可以在實驗室內製造．大部份的"製造鑽石"用作工業上的磨具．

市場行銷

寶石的價值視乎人們對其的熱愛，而市場行銷是"增加"其價值的重要因素．

對一般人來說，要辨別寶石的素質是十分困難的．為此，非牟利組織美國寶石研究院(GIA)為一般顧客提供寶石鑑別及購買意見，亦為珠寶業行內人士提供培訓．

經 GIA 鑑定的寶石會附有一張證明其素質的證書 而這些其有證書保證的寶石售價一般會較市價為高．

對於消費者來說，購買"製造寶石"或"處理寶石"是一個有趣但難於決定的選擇．當然大部份人仍偏向天然寶石，但其售價往往令人卻步．重要的是，經處理的寶石亦能表現天然寶石的所有重要特質，所以我們不應該因為其不是天然而認定它們是低素質的寶石．

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Oriental and Other Exotic Gemstones

Jade

Jade has been in the Chinese culture for thousand of years and the Chinese are fascinated with it. Jade was also used by the Olmec and Mayan people in South America. Jade is a general term for two minerals — **jadeite** and **nephrite**. However, jadeite and nephrite are two different chemical groups.

Jadeite — $Na(Al,Fe^{3+})Si_2O_6$

Jadeite is a pyroxene mineral with a hardness of 6.5 — 7. Jadeite is formed in metamorphic rock under high pressure and low temperature conditions. It is also known as "hard jade" or Feicui by the Chinese and it is rarer than nephrite. Most of the gemstone grade jadeite are originated from Myanmar.

Nephrite — $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$

Nephrite is a an amphibole mineral with a hardness of 6 — 6.5 and it is also referred as "soft jade" by the Chinese. It has a lower value than jadeite.

The Chinese love jade not only because of its beauty, but it also symbolizes beauty, nobility, perfection, constancy, power, and immortality in the Chinese culture.

Other Exotic Gemstones

Tanzanite was discovered in 1967 and was enthusiastically celebrated by specialists as the "gemstone of the 20th century"; it has a ultramarine blue to light violet-blue colour and is only found in Tanzania. Thus, it is marketed as "1000 times rarer than diamond."

Alexandrite is an unique gemstone that has a sensational feature of having the ability to change colour; the stone is a green or bluish-green in daylight but turns into a soft shade of red, purplish-red or raspberry red in incandescent light. This characteristic is a great marketing point for this stone.

玉石

玉石在中國文化已有數千年的歷史，中國人一向對其十分喜愛．在南美洲，奧爾梅克人和瑪雅人也有使用玉石．玉石是兩種不同礦物的統稱－硬玉及軟玉．但是，硬玉及軟玉本身是屬於不同的化學類別的．

硬玉 - $Na(Al, Fe^{3+})Si_2O_6$

硬玉又稱翡翠，是一種輝石礦物，硬度為6.5 - 7．硬玉在高壓及高溫下的變質岩下生成，它比軟玉稀有．大部份達到寶石級別的硬玉都來自緬甸．

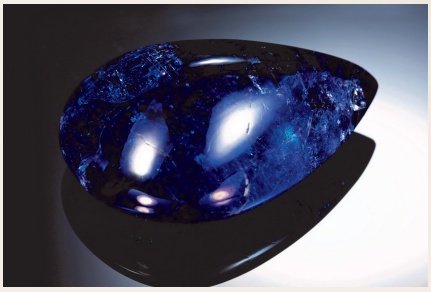
軟玉 – $Ca_2(Mg, Fe)_5Si_8O_{22}(OH)_2$

軟玉又稱田玉，是一種閃石礦物，硬度為6 - 6.5．它的價值比硬玉為低．

中國人喜歡玉石不單單因為其美麗，玉石代表了中國文化的美麗、貴氣、完美、堅定、力量及不朽．

其他特別的寶石

丹泉石於1967年被發現，當時寶石專家熱烈興祝時稱其為"二十世紀寶石"．它的顏色為群青藍至淺紫藍色．丹泉石只產於坦桑尼亞，所以市場稱其"比鑽石更稀有1000倍"．



紫翠玉是一種擁有善變特質的特別寶石．它可改變其顏色，在日光下，它呈綠色或藍綠色；但在白熾燈光線下，它則呈暗紅色、紫紅色及紅莓紅．這種特質是市場行銷時的重要賣點．

Top: Tanzanite; Bottom: Alexandrite
上：丹泉石； 下：紫翠玉