ROCKHOUND NEWSLETTER
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MINING • ENERGY • NATURAL RESOURCES
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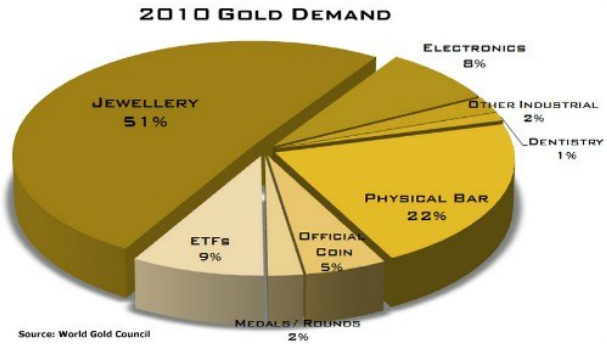
Gold

Gold is a precious and relatively scarce metal. The particular combination of its attractive colour, high corrosion resistance and the ease with which it can be worked and shaped has resulted in it being cherished as a valuable commodity for many thousands of years. Although gold is often thought to be rare, it is actually the 58th most abundant natural element out of the 92 contained in the Earth's crust.

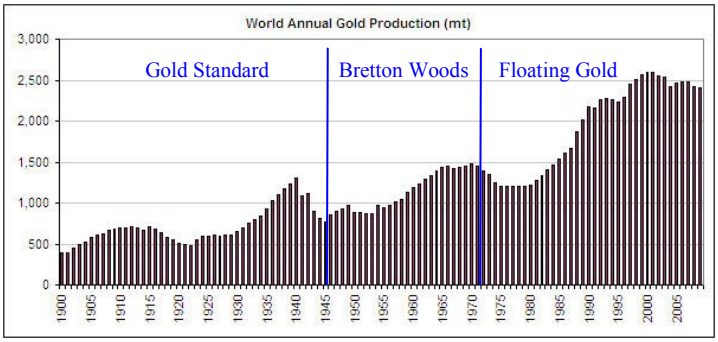
Gold has high electrical and thermal conductivity, biocompatibility, malleability and ductility. Consequently it is used in jewelry, electrical circuitry, medical technology, and a diverse range of industrial applications as well as chemical production.

Since the beginning of civilization, it is estimated that 166,600 tonnes of gold has been mined, of which nearly 40% has come in the past 120 years from "the Rand" – the Witwatersrand Basin in South Africa. In 2009-2010, China was the world's largest gold producer, overtaking South Africa and the USA (Russia and Peru have recently been 4th and 5th). In 2010 China produced about 340 tonnes compared to typical world production figures during the past decade of 2,300-2,600 tonnes per annum. Although more than 90 countries have gold mines, the 8 largest nation-state producers account for more than 50% of the total.

The time of gold rushes, finding large nuggets or kilograms of alluvial gold dust is gone. Today gold mining mainly comprises large-scale production from rocks which only contain a few grams per tonne.



2010 Gold Demand in different industry 2010 各行業對黃金的需求



World gold production (1900-2010) 世界黃金年產量 (1900-2010)
http://news.goldseek.com/SpeculativeInvestor/1257837120.php

Geological deposition

Gold is concentrated by geological processes and can become a commercially mineable deposit. There are two principal types of deposit:

Primary (Lode) deposits: hot mineralized fluids carrying dissolved gold are intruded into the bedrock from below. In broad terms these either form concentrated "vein" gold or gold that is 'diffused" throughout parts of the parent rock in relatively low concentrations. In lode deposits, gold is frequently associated with silver, arsenic, and base metals (i.e. copper, lead, and zinc). Gold content is expressed in grammes or troy ounces per tonne.

Secondary sedimentary (Placer/alluvial) deposits: When the gold bearing bedrock is eroded, disintegrated and decomposed, gold, which is extremely resistant to weathering, will be freed and concentrated by means of gravitation. In placer deposits, it is usually found within "black sands", which are concentrated with

黃金

黃金是珍貴及相對稀有的金屬。它不但顏色吸引、高度防蝕，還易於開採及塑造成不同形狀。因此，性質獨特的黃金，數千年來都視為價值連城的珍品。雖然大家經常覺得黃金很罕有，但就蘊藏在地殼內的 92 種天然元素而言，它是第 58 種存量最豐富的元素。

黃金有高度的導電及導熱性、生物相容性及延展性。因此，它會用於珠寶、電路系統、醫學科技，以及各種工業用途及化學產品。

從文明時代起計算，估計約 166,00 噸的黃金被開採，當中的 40%於過去 120 年出產黃金來自「蘭德」－南非威特沃特斯蘭德盆地。2009 年至 2010 年，中國超越南非及美國，成為全球最大的黃金生產國(俄羅斯及秘魯最近排名第四及第五位)。2010 年，中國生產約 340 噸黃金，相比過去十年，世界生產數字每年 2,300 至 2,600 噸。雖然全球超過 90 個國家擁有金礦，但八個最大的民族生產國已生產超過總額 50%的黃金。

淘金熱、覓得大型金塊或數公斤砂金金粉的時期已過。現時，業界主要大規模地從石頭採金，但每噸石頭只含數克黃金。

成礦過程

黃金由地質作用聚集起來，開採黃金礦床時亦具商業利益。主要有以下兩種礦床：

原生(脈狀)礦床：含溶解黃金的熱礦化液從底部進入基岩。籠統而言，這些礦床由密集的「岩脈」黃金或「分散」於母岩不同部分的黃金組成，但後者的密度相對較低。在脈狀礦床中，黃金經常與銀、砷及基底金屬(即銅、鉛及鋅)同時聚集。含金量會以每噸多少克或金衡盎司表達。

次生沉積(砂礦)礦床：當含金的基岩被侵蝕、粉碎及分解，抵禦風化能力極高的黃金會因萬有引力而離開岩石，並聚集起來。在砂礦內，黃金通常在「黑砂」中尋獲，當中還會與其他金屬礦物，尤其是鐵、鋅及鉻同時聚集。有別於脈狀礦床，沉積序列的含金量通常以容重(每立方米多少

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other metallic minerals particularly those of iron, zinc and chrome. Unlike primary deposits the gold content of sedimentary sequences is usually represented as weight per volume (grams per cubic meter).

Mining

The most widely worked Lode deposits are vein type. Only veins with a significant thickness or a series of closely spaced gold veinlets are mined. Typically gold mines are underground but it is also possible to have open pit mines for near surface deposits. In the past surface vein deposits (and placers) have been the cause of gold rushes since the gold can be seen. In contrast, diffused gold (currently commercially viable at 1 gramme per tonne (1g/t) of rock or so, such as found in large scale porphyry deposits) cannot be readily observed and are rarely worked by artisanal miners since they normally require large-scale (bulk) mining and processing operations. Grassberg, in Papua, Indonesia, the largest gold porphyry mine in the world is worked at grades as low as 1 g/t. Some small operations in Australia have also worked rock where the gold content is 0.5g/t and been commercially viable.

Pure gold has a high specific gravity (density of 19.3 t/m^3) which means it is some 19.3 times heavier than water (water is the universal gravity standard with 1 cubic metre (1m^3) weighing 1,000kg or 1 tonne (1t)). The specific gravity of impure gold ranges from 16 - 18 t/m^3 whereas waste rock (and rock generally) has a specific gravity of about 2.5 (i.e. a density of 2,500 kg (2.5 t/m^3). This density difference allows gold minerals to be separated using gravity separation techniques such as gold panning, rockers and sluice boxes. Placer deposits are worked by dredging or hydraulic mining. The mined ore is then processed with a simple gravity separation process. In the 1800's the high density of gold was employed by early miners to distinguish it from "Fools gold" (Iron sulphide, FeS_2 or Pyrite) which is considerably lighter at about 5.1 times the weight of water. Consequently it was gold's density that enabled it to be distinguished and worked without complex equipment (simple panning) during the early gold rushes.

Processing

Traditional gold processing has used mercury extraction. Mercury will form an amalgam as it comes into contact with gold. The amalgam will then be heated to vaporize the mercury and recover the gold. Use of this traditional process, called **amalgamation**, is diminishing as mercury causes significant pollution problems and environmental devastation. Small scale placer miners, especially in developing countries, still use mercury to recover gold, particularly in South America.

Gold dissolves in sodium or potassium cyanide and the gold-bearing solution can be subsequently treated for recovery purposes. The most commonly

Facts:

* Gold is measured in troy ounces
  1 troy ounce = 31.103g or 1.097 avoirdupois ounce
  1 tonne = 32,151 troy ounces
* It rarer to find a one ounce nugget of gold than a five carat diamond. "Welcome Stranger" weighing 2,316 troy ounce was the largest nugget ever found (1869 at Moliagul, Australia).
* Other than sodium or potassium cyanide, gold dissolves only in aqua regia (mixture of hydrochloric acid and nitric acid)

資料：

* 黃金以金衡盎司量度
  1 金衡盎司 = 31.103 克或 1.097 常衡盎司
  1 噸 = 32,154 金衡盎司
* 尋獲一盎司的金塊，比尋獲五卡鑽石更難。「歡迎陌生人」是歷來尋獲最大的金塊，重 2,316 金衡盎司(1896 年在澳洲蒙利拉格發現)。
* 除了氰化鈉或氰化鉀 ，黃金溶於王水(鹽酸及硝酸的混合物)。

Top: miners and their family and finders of the Welcome Stranger; Bottom: replica of the Welcome Stranger
上:「歡迎陌生人」的發現者、其他礦工及其家人; 下:「歡迎陌生人」的複製品

克)表示。

開採黃金

最常開採的礦床，是屬於岩脈型的脈狀礦床，但只有相當厚度的岩脈或連續多條的密集小金脈會獲開採。一般來說，金礦都在地下，但亦有可能因開採接近地表的礦床而作露天開採。以前出現淘金熱，都是因為地表脈狀礦床(及砂礦床)的黃金清晰可見。相反，分散的黃金(現時，在大型的黃金斑岩礦床等地方採金時，可在每噸石頭圖得一克黃金(1 克／噸)左右)令人難以察覺；進行開採時，又涉及大型(大量)採礦及處理工作，所以傳統的礦工很少開採這種黃金。印尼巴布亞島的格拉斯伯格有全球最大的斑岩礦床，但採出低至 1 克／噸。部分在澳洲的小型採礦活動，亦會開採含金量為 0.5 克／噸的石頭，並且有利可圖。

純金的比重高(密度為 19.3 噸／立方米) 即比水重約 19.3 倍(水的密度為通用標準值，每一立方米重 1,000 公斤或一噸)。非純金的比重在 16 至 18 噸／立方米之間，而廢石(以及一般的石頭)的比重則為 2.5 噸／立方米左右(即密度為每立方米 2,500 公斤(2.5 噸))。這種密度上的差異，容許業界利用重力分離法，例如選金鍋、淘金搖動槽及聚金箱，把黃金礦物分隔出來。砂礦床以採礦船或水力採礦法開採。已開採的礦石其後會以簡單的重力分離過程處理。由於黃金的密度高，所以在十九世紀的早期礦工以此來分辨出遠輕於水 5.1 倍左右的「愚人金」(硫化鐵、二硫化鐵或黃鐵礦)。因此，在早期的淘金熱時，黃金的密度使其易於辨別，並且無須使用複雜的設備(只須簡單的選金鍋)來開採。

處理黃金

汞提法是傳統用來處理黃金的方法。汞接觸黃金後，會形成汞合金。汞合金後來會被加熱，並把汞變成蒸氣，因而把黃金復原。由於汞會造成嚴重的污染問題及環境破壞，因此這種稱為**汞齊化**的傳統處理法，正日漸減少使用。小型砂礦的礦工，特別是在發展中國家的礦工，仍以汞把黃金復原，當中以南非尤甚。

黃金會溶於氰化鈉或氰化鉀，該含金的液體其後會經過處理，用來把黃金復原。最常用的方法是**碳化復原**，當中以活性碳吸取溶解的

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used method is **carbon-in-pulp**, which uses activated carbon to absorb the dissolved gold. **Heap leaching** is another process and typically uses cyanide to extract gold from low grade ore. Here a cyanide solution seeps through a large heaped stockpile of ore and in doing so the gold is dissolved and mobilized to be collected elsewhere.

Flotation processes can also be employed. These chemically bind gold to the surface of bubbles created by chemical reaction and surface tension, enabling gold to be collected at the surface.

黃金。**堆浸**是另一個把黃金復原的步驟，常以氰化物從低級礦石提取黃金。含氰化物的液體會滲進一大堆儲備的礦石，然後黃金便會溶解及流動，礦工可於其他地方收集溶液。

此外，亦可使用浮選法。這種方法以化學原理把黃金黏附在因化學反應及表面張力而產生的氣泡的表面，因而可在其表面取得黃金。

Bre-X Scandal and Standards

Bre-X Minerals Ltd. was a major part of Bre-X, a group of companies based in Canada.

Bre-X was originally a penny stock and its stock price reached CAD $286.50 (split adjusted) in May 1996 on the Toronto Stock Exchange (TSX).

However, Bre-X Minerals collapsed in 1997 and was one of the biggest stock scandals in Canadian history and the biggest mining scandal of all time.

Bre-X Minerals Ltd. was founded in 1989. In 1993, the company acquired a gold mineral property near the Busang River in Borneo, Indonesia. The project was first estimated at approximately 2 million ounces and was finally estimated at 70 million ounces in 1997. However, fraud was eventually suspected because the story became "too good to be true". After investigation (due diligence) it was found that alluvial gold (easily recognized because of its more rounded in shape) had been added (or "salted" in mining jargon) to the core samples recovered from boreholes being sent for assay, in which the gold was seen to be more angular in shape.

The Canadian National Instrument 43-101 code was subsequently introduced to standardize and regulate the minerals reporting standard to protect investors from misleading, erroneous or fraudulent information. Today, many international standards (refer RH Newsletter No. 1) exist to help regulate the reporting of exploration and mining results.

Bre-X 醜聞及標準

Bre-X Minerals Ltd.是 Bre-X 的主要組成部分，而 Bre-X 則是一群以加拿大為基地的公司。

Bre-X 本來是蚊型股，但其股價於 1996 年 5 月在多倫多證券交易所達至 286.50 加元(經除權調整)。

不過，Bre-X Minerals 於 1997 年倒閉。這是加拿大史上其中一宗最大的證券醜聞，並且是歷來最大的礦業醜聞。

Bre-X Minerals Ltd.於 1989 年成立。1993 年，該公司在印尼婆羅洲布桑河附近覓得黃金礦產資源。計劃最初預算可開採 200 萬盎司左右的黃金，但最後在 1997 年卻預計為 7,000 萬盎司。不過，由於事情「好得令人難以置信」，最終有人懷疑這是個騙局。調查(盡職調查)後發現，送往檢驗的岩心樣本加入砂金(經沉積後變圓，因此易於分辨)。

其後，業界引入加拿大的《國家礦物開採 43-101 標準》，以統一及規管礦物報告的標準及保護投資者免被誤導、欺騙或取得虛假資料。現時，有很多不同的國際標準(請參閱石犬通訊第一期)，以協助規管開採礦物的報告及採礦結果。

In the current highly connected, frenetic and uncertain investment climate, gold remains one of the most sought after, durable and reliable safe havens. Gold price escalation has encouraged the revisiting of exploration sites and mines.

現時各國的投資市場高度相連、交投活耀，並且變化無常，但黃金依然是其中一處最受追捧、持久不變及值得信賴的避風港。黃金價格的增長，鼓勵了金礦資源勘探及對棄置金礦的重新評估。

References: World Gold Organization (www.gold.org)

Gold and US dollars

The use of gold in monetary exchange and investment is perhaps its most commonly recognized role. At the end of the second world war one troy ounce of gold was fixed at US$35 according to the Bretton Woods agreement. The convertibility between gold and US dollars was ended by President Nixon in 1971 to stabilize the US economy and fight inflation. Gold was adopted as a standard in the first place to restore monetary order and obligate independent nation states to adopt monetary policy and maintain exchange rates. The agreement also instigated the formation of the IMF and a precursor of the World Bank. After 1971 the dollar then became "fiat currency" (a value determined and backed by the nation state). Consequently during periods of recession the price of gold may dramatically increase, as can be seen today.

黃金和美金

黃金最為人熟悉的用途，或許是用來兌換貨幣及進行投資。第二次世界大戰快要結束時，根據《布雷頓森林協定》的條款，一金衡盎司黃金定價為 35 美元。1971 年，尼克遜總統停止黃金與美金互換，以穩定美國經濟及打擊通漲。最初，黃金曾作為恢復貨幣秩序、強迫獨立民主國家採取貨幣政策及維持兌換率的標準。該協定亦促使國際貨幣基金組織的成立，並成為世界銀行的先驅。美國單方面在 1971 年終止其貨幣與黃金互換，而《布雷頓森林協定》亦正式結束。後來，美金變成「法幣」(由民族國家決定價值及支援)。結果，在經濟衰退期間，黃金價格或會大幅上升，即使現在也有這種情況。

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MCIM – Member of the Canadian Institute of Mining and Petroleum

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委內瑞拉正式將國內金礦收歸國有 *24/8/2011 <新華網>*

Venezuela Nationalizes All Gold Mines

據法國媒體報道，委內瑞拉總統查韋斯23日簽署行政命令，正式將國內金礦收歸國有，並宣布第一批匯回黃金即將抵國。

委內瑞拉官方媒體報道，查維斯在部長級會議上簽訂“將黃金開採、管理，還有其他相關活動收歸國有的自然法”。

他在會上還解釋說，他簽署這條行政命令是“為強化國家獨立和經濟獨立”。

查維斯上周就宣布有意將國家的金礦產業收歸國有，防止“黑道分子”染指國家自然資源。委國黃金產量60%來自非法開採。

紫金 5億購吉爾吉斯金礦 *17/8/2011 <蘋果日報>*

Zijin Proposed Acquisition of a Gold Mine in Kyrgyz Republic

紫金礦業（ 2899）公佈，收購吉爾吉斯共和國 Chui oblast區域的左岸金礦 60%股權，現金總代價 6600萬美元（約 5.1億港元）。據左岸金礦提供的資料顯示，礦石量 890.6萬噸，黃金平均品位每噸 7.23克，其中 C1級別（首期開採儲量）的礦石量 494.98萬噸，黃金平均品位 7.02克。

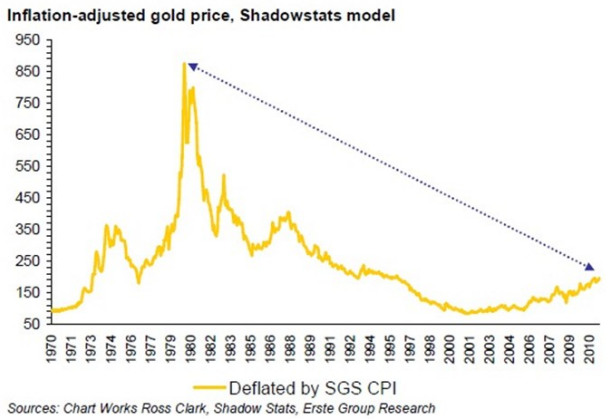
Gold Price and Gold Miners

As gold price has increased over 280% from around $600 US in 2007 to above $1,700 US recently, some expect stock prices of gold mining company would have also increased by about the same percentage. However, stock prices of gold miners increased by a relatively minimal percentages only. Many questioned why.

Inflation and Operating Cost

Gold selling price is settled in US dollars. The current devaluation of US dollars has caused inflation and a hike in operating cost. Moreover, currency in resources rich countries, such as Australia and Canada, are relatively strong such that the overhead cost and labor cost of gold mines increase as well.

The increase in cost has a negative impact on the earnings of gold miners.



Sources: Chart Works Ross Clark, Shadow Stats, Erste Group Research

Interruption of production

Recently, some natural disasters affected the production of gold mines. Labor disputes have also interrupted some gold mining operations. These interruptions affected the performance of the gold mining stocks.

Hedging of mining company

Mining companies do hedge against their producing commodities to protect themselves from the fluctuating commodity prices. Some gold miners did not believe that the high gold price can be sustained, their hedging have limited their up gain in the past couple years.

Capital

Some gold mining companies spent their cash acquiring gold mines but they lacked the cash to further develop the project to bring it into production.

Other options of gold related asset investments include paper gold, gold margin trading and SPDR* ETF.

(*SPDR stands for S&P's Depository Receipts)

Sources: World Gold Council, Kitco

公司名稱	代碼	PE (11E)	PE (12E)	EV/ EBITDA (11E)	EV/ EBITDA (12E)
招金礦業	1818	20.2	15.2	11.1	9.8
紫金礦業	2899	9.8	9.0	7.9	6.9
中國貴金屬	1194	9.1	5.6	7.5	4.1
中國黃金國際	2099	17.0	10.8	10.5	6.5

資料來源: 交銀國際 (數據截至 10/8/2011)