UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

COMMODITIES AT A GLANCE

Special issue on gold

N°6

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The series Commodities at a Glance aims to collect, present and disseminate accurate and relevant statistical information linked to international primary commodity markets in a clear, concise and reader-friendly format.

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EXPLANATORY NOTE

All data sources are indicated under each table and figure.

Reference to dollars or use of the symbol, $, signifies United States dollars, unless otherwise specified.

The term “tons” refers to metric tons.

Unless otherwise stated, all prices in this report are in nominal terms.

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UNCTAD/SUC/2015/3

NOTES

Gold can be measured in troy ounces or in kilograms. According to the World Gold Council:

1 gram	(0.032151 troy ounces)	→	1 troy ounce	(31.103 grams)
1 kilogram	(32.1507 troy ounces)	→	1 troy ounce	(0.0311 kilograms)
1 ton	(32'150.75 troy ounces)	→	1 troy ounce	(0.000031 tons)

GLOSSARY OF TERMS

Above-ground reserves: This source of gold reserves represents an additional category to the traditionally agreed concept of reserves, defined as all quantities of minerals economically extractable from the ground. The term "above-ground reserves", used mainly in the gold industry, defines all quantities of gold that have already been mined in human history. They include all stocks of jewellery, gold held by central banks and private investors, as well as all gold fabricated products.

All-in sustaining costs (AISC): is a voluntary non-GAAP [Generally Accepted Accounting Principles] measure proposed by the World Gold Council to gold mining companies in 2013. This indicator covers cash costs, plus the costs incurred by the sustainable production of mines during their complete life cycle – from exploration to closure. Most of the largest gold companies now publish this indicator in their annual reports. (See World Gold Council, Guidance note on Non-GAAP metrics – all-in sustaining costs and all-in costs. 27 June 2013, at: http://www.gold.org/research/guidance-note-non-gaap-metrics-%E2%80%93-all-sustaining-costs-and-all-costs).

Fineness: Defines the gold content of an alloy or impure gold. It is expressed in parts per thousand (ppm). For example, when a material contains 90 per cent gold and 10 per cent of another metal, it is referred to as "900 fine".

Karatage: In jewellery, when gold is alloyed with other metals, the weight of gold in the product is measured in karats (k). Pure gold equals 24 karats.

Primary production: Output from large mines, regulated gold mines (excluding informal and artisanal production).

Secondary production: Mainly refers to production from recycling.

ABBREVIATIONS

AISC	all-in sustaining costs
ASGM	artisanal small-scale gold mining
CBGA	Central Bank Gold Agreement
ETF	exchange-traded fund
GFMS	Thomson Reuters GFMS Surveys
ICME	International Council on Metals and Environment
IMF	International Monetary Fund
INR	Indian rupee
K	karat
K	kelvin
kPa	kilopascal
m3	cubic meter
mg	microgram
mm	micrometre
n.a	not available
oz	ounce(s)
pgm	platinum group metals
ppm	parts per million
RMB	Chinese renminbi
UAH	Ukrainian hryvnia
UNEP	United Nations Environment Programme
USGS	United States Geological Survey
WHO	World Health Organization

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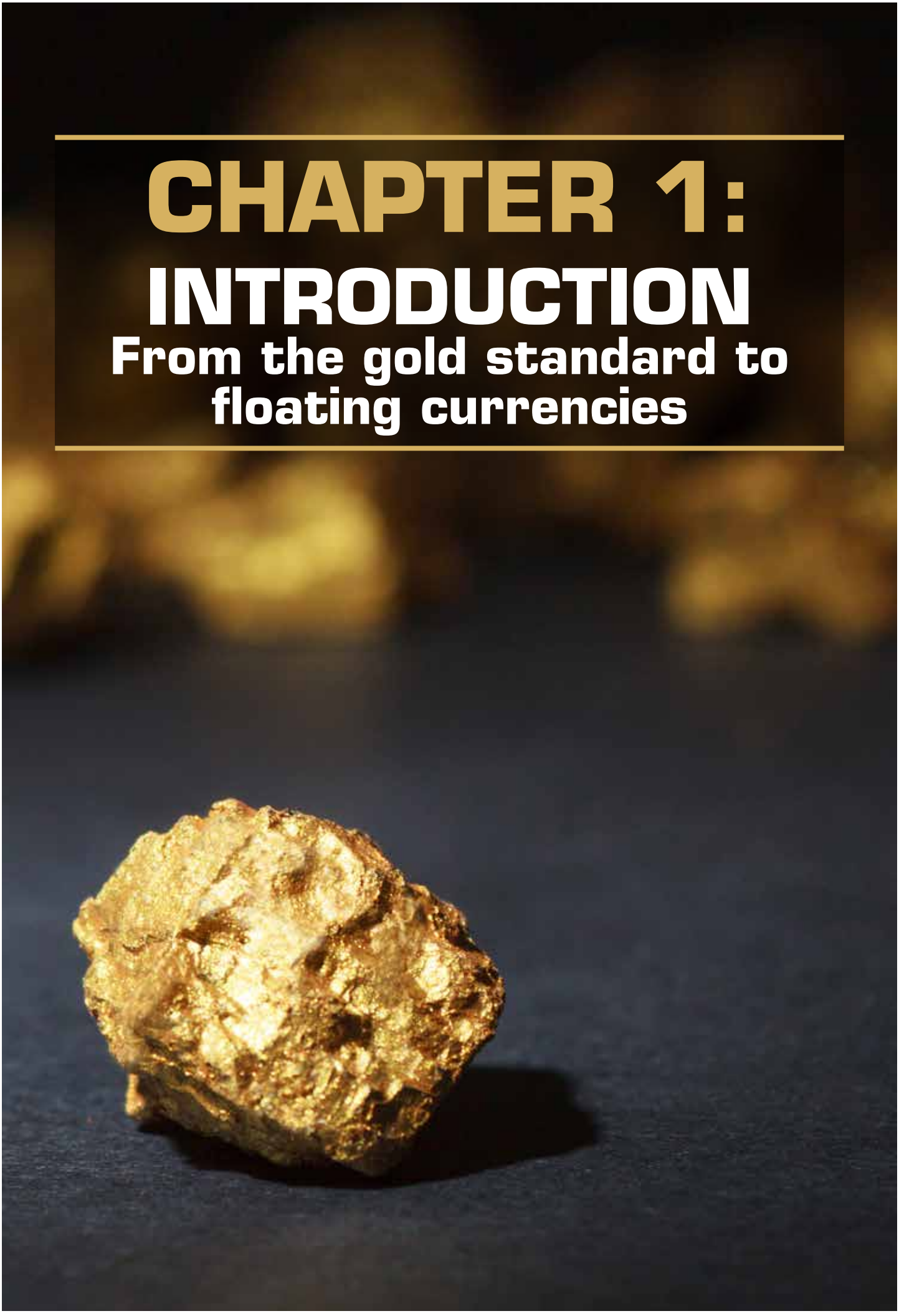
CHAPTER 1:
INTRODUCTION
From the gold standard to floating currencies



1. THE CHARACTERISTICS OF GOLD

Gold is a precious yellow, bright and highly valued metal. It has been known, appreciated and used for thousands of years. The first documented goldmine in the world, estimated to be 4,000 years old, was discovered in Tbilisi (Georgia) in 2005.

The origins of gold are considered to be "cosmic". In 2013, the Harvard-Smithsonian Center for Astrophysics noted that observations have found evidence that gold was created in a short gamma-ray burst resulting from "the collision of two neutron stars – the dead cores of stars that previously exploded as supernovae".[1]

Symbol: Au (from Aurum)
Atomic number: 79
Density: 19.32 g/cm3
Melting point: 1,064°C
Atomic mass: 196.97 atomic mass units (amu)

Gold is among the rarest elements in the earth's crust (table 1), where it is mainly present in its native form (about 80 per cent of the total metal worldwide); it can also be associated with other elements, such as silver – resulting mainly in the elements, electrum and tellurium – but also with copper or iron, among others.

Gold is the most malleable and ductile transition metal, meaning that it can be shaped and bent easily. It is considered a heavy metal and one of the densest elements in the periodic table. Like silver, iridium, osmium, palladium, platinum, rhodium and ruthenium, it is a noble metal, which means that it presents an exceptional resistance to oxidation. However, gold can be dissolved in aqua regia.[2] Gold is also a good conductor of heat and electricity, and a strong reflector of infrared radiation. Based on these characteristics, it is used as input in many industries, such as jewellery, dentistry or electronics, and for electrical applications. However, its softness and high prices ($1,428 per troy ounce, on average, between 2010 and 2014) tend to limit its use to sectors where no efficient substitutes have been developed, or encourage its mixture with other metals (e.g. silver, copper, platinum group metals). Gold is also used for monetary purposes (e.g. coinage), and as a safe-haven asset and investment vehicle during periods of economic uncertainty.

Table 1. Concentration of gold and other selected industrial and precious metals in the earth's crust (ppm)

Atomic number	Name	Symbol	Crust abundance (ppm)	Group
13	Aluminium	Al	79 000	Industrial metal
26	Iron	Fe	55 350	Industrial metal
12	Magnesium	Mg	26 000	Industrial metal
22	Titanum	Ti	6 302	Industrial metal
25	Manganese	Mn	1 156	Industrial metal
24	Chromium	Cr	131	Industrial metal
28	Nickel	Ni	90	Industrial metal
30	Zinc	Zn	76	Industrial metal
29	Copper	Cu	59	Industrial metal
82	Lead	Pb	13	Industrial metal
50	Tin	Sn	2.27	Industrial metal
74	Tungsten	W	1.29	Industrial metal
42	Molybdenum	Mo	1.27	Industrial metal
47	Silver	47	0.0750	Precious metal
46	Palladium	Pd	0.0082	Precious metal
78	Platinum	Pt	0.0036	Precious metal
79	Gold	Au	0.0032	Precious metal
76	Osmium	Os	0.0018	Precious metal
44	Ruthenium	Ru	0.0010	Precious metal
45	Rhodium	Rh	0.0010	Precious metal
77	Iridium	Ir	0.0008	Precious metal

Source: UNCTAD secretariat.

2. THE ROLE OF GOLD IN ECONOMIES

Gold plays a vital, multidimensional role in both local and international economies. In gold-producing developing countries, it may account for a large share of their merchandise export revenues.[3] For instance, it accounted for more than 40 per cent of the export revenues of Mali, Burkina Faso and Guyana between 2009 and 2013, and for 56 per cent in Suriname in 2013. Gold is also a source of substantial government revenues through taxes

[1] Harvard-Smithsonian Center for Astrophysics, Earth's gold came from colliding dead stars, 17 July 2013 (see: https://www.cfa.harvard.edu/news/2013-19).

[2] Described by Oxford Dictionaries online as "A mixture of concentrated nitric and hydrochloric acids. It is a highly corrosive liquid able to attack gold and other resistant substances".

[3] Gold. Standard International Trade Classification, Revision 3. 971, gold, non-monetary (excluding gold ores and concentrates).

and royalties on mining and processing activities. Moreover, while activities associated with gold are generally capital-intensive, they nevertheless represent an important source of local employment, with about 50,000 people directly or indirectly employed by the gold sector in Australia[4] and around 300,000 people in South Africa, for instance. In all, according to World Gold Council estimates, about 100 million people rely on gold mining activities for their livelihoods. [5]

The United States Geological Survey (USGS) estimates that world gold reserves stood at 54,000 tons in 2014, representing about two decades of production, in terms of current world production.[6] From a historical perspective, gold reserves have been located largely in South Africa (24 per cent of world reserves, on average, between 1996 and 2014). However, the country's share in world gold reserves has been declining sharply over the period, falling from 41 per cent in 1996 to 11 per cent in 2014. Since 2011, Australia has been the world's leading gold reserves. As on February 2015, the three main gold reserves were located in Australia, South Africa and the Russian Federation (figure 1). Together, these three countries accounted for 38 per cent of world reserves in 2014. Other gold reserves are widely spread around the world, with no country having reserves exceeding 18 per cent of the world total in 2014 (compared with 30 per cent in the case of copper, for instance).

Oceans could be a good potential reserve for gold. Indeed, oceans are estimated to contain up to 15,000 tons of gold, according to the World Gold Council, which would represent more than a quarter of total world reserves, as estimated by the USGS in 2014. However, extraction of gold from the oceans is currently not considered economically viable.

In addition to gold found in precious metal deposits, it is also commonly recovered during the smelting or refining processes of base metals. It is generally accepted that between 5 per cent and 15 per cent of total gold worldwide is extracted as a by-product.

3. RECENT HISTORY OF GOLD AS A CURRENCY

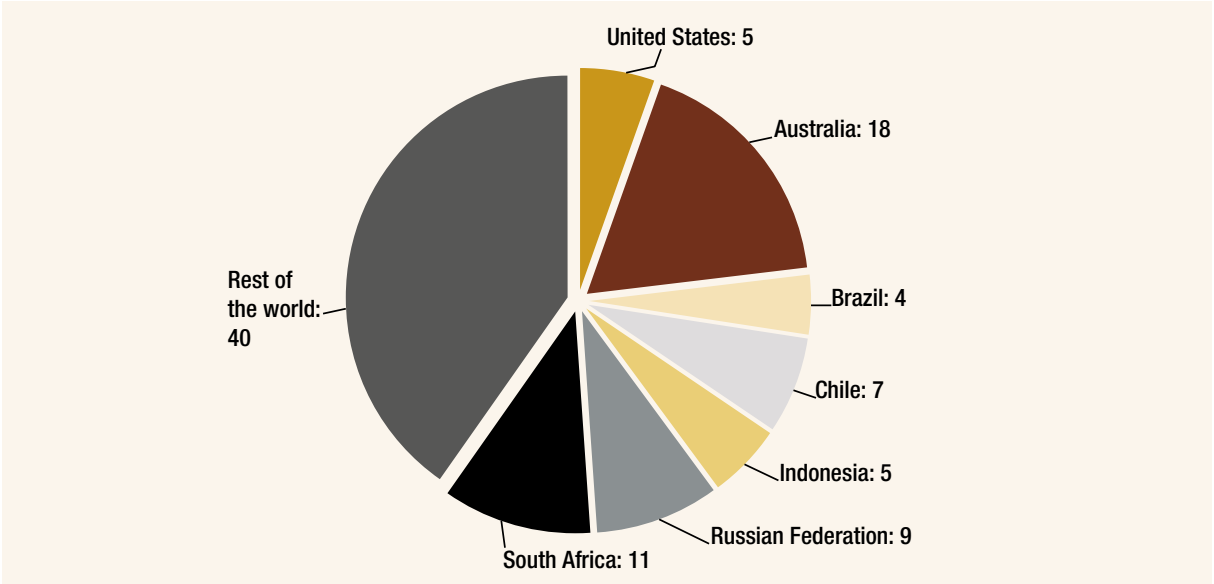
Up to the end of the nineteenth century, the history of gold may be divided into three main periods (figure 2): (i) The gold standard system from 1870 to 1914, (ii) the Bretton Woods system, between the end of the Second World War and 1971; and (iii) the current global free-floating exchange rate system which started in 1971.

[4] Minerals Council of Australia, Australia's gold industry: employment (see: http://www.minerals.org.au/resources/gold/employment/).

[5] See: Gold facts, at: http://www.goldfacts.org/en/.

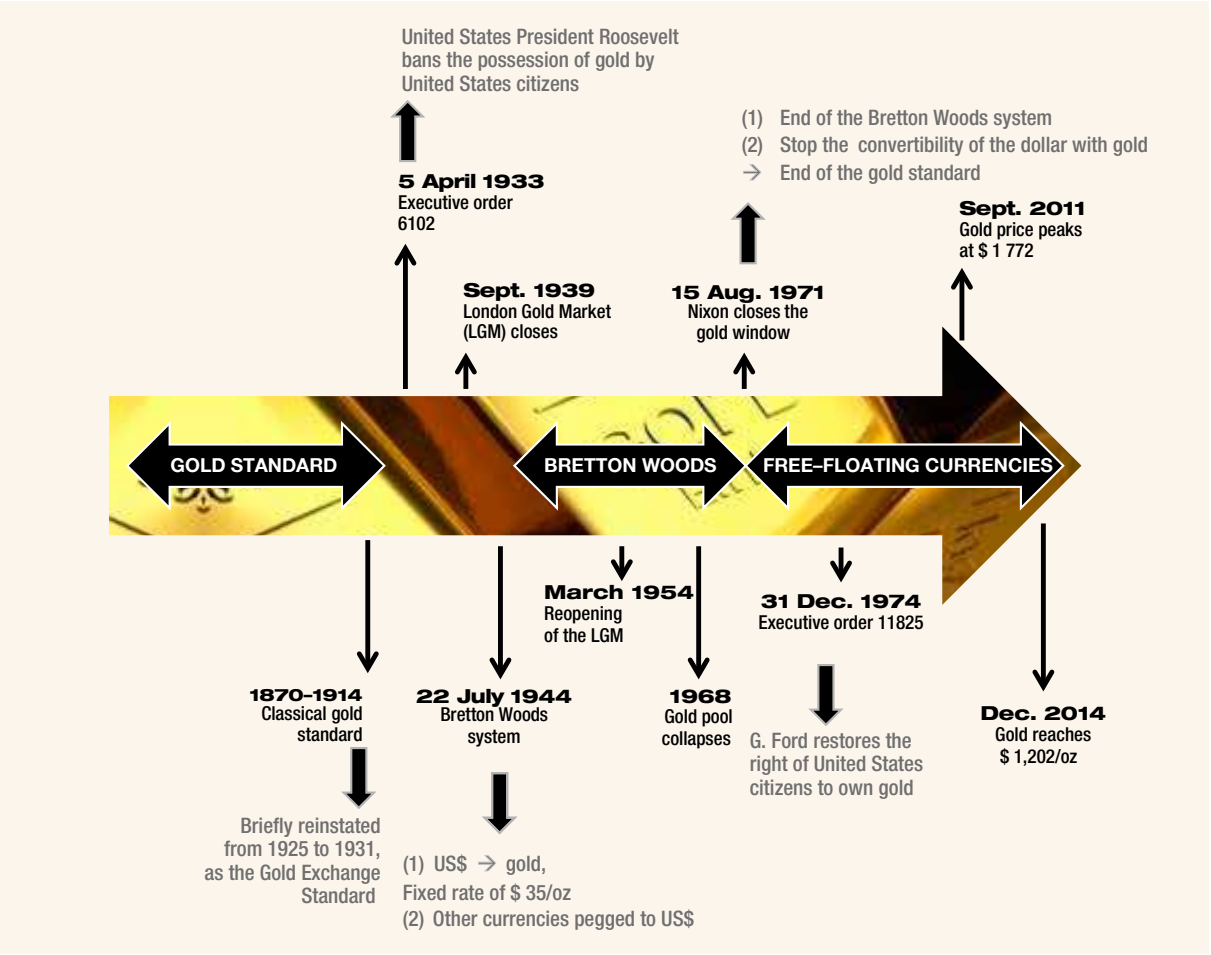
[6] Based on 2012 production data; however, this computation does not take into account "reserve base" data or other identified and not already identified sources which are (or could) be discovered and mined economically.

Figure 1. Share of country gold reserves in total gold reserves, February 2015 (per cent)



Source: UNCTAD secretariat, based on United States Geological Survey, *Mineral Commodity Summaries*, February 2015.

Figure 2. Overview of the recent history of gold



Source: UNCTAD secretariat.

a. The Gold Standard system (1870–1914)

The gold standard system, in place during the period 1870–1914, used gold as the world's common unit of account. This meant that the value of each participating currency was determined according to a specific weight in gold. Each currency could be freely converted into gold, and the nominal exchange rate between two currencies was fixed according to their respective gold content. Within this system, the maximum amount of money that could be issued by central banks was determined by the level of its domestic gold reserves. The gold standard had already been in place in the United Kingdom since 1821, but the system was extended to cover other countries during the 1870s.

The gold standard system came to an end with the beginning of the First World War. After a period of free-floating exchange rates from the end of the First World War to the beginning of the Great Depression, a few countries joined forces to try to revive a system similar to that of the gold standard. However, the difficult political situation, notably in Europe, fears regarding high inflation risks and the beginning of the Great Depression, followed by the Second World War, led to the definitive collapse of the gold standard system.

b. The Bretton Woods system (1944–1971)

Named after the New Hampshire town where the Bretton Woods Agreement was signed, the Bretton Woods system aimed at establishing an adjustable peg currency regime. Each of the participating countries was required to fix its exchange rate by tying it to the United States dollar, which itself was pegged to gold at a fixed value of $35 per troy ounce. The United States currency was chosen as a reference as that country held three fourths of the world's gold stocks at that time.

The system was more flexible than the former gold standard system as the Bretton Woods Agreement allowed a fluctuation of the parity of currencies within a range of more or less 1 per cent around the peg. This flexibility was expected to allow the correction of fundamental disequilibria. Outside this range, stakeholders were required to intervene by buying or selling their currency.

c. The end of the Bretton Woods system and the start of a free-floating exchange rate system (1971 to the present)

From the beginning of the 1960s, the US dollar started to be seen as overvalued compared with the value defined in the Bretton Woods Agreement. As a result of the rapid expansion of international trade and military spending, the volume of US dollars in circulation increased dramatically and finally exceeded the value of gold effectively held by the United States (at the rate of $35 per troy ounce). The Bretton Woods system collapsed in 1971, following the decision of the United States President, Richard Nixon, to suspend the convertibility of the US dollar into gold. Since 1973, most countries have turned to a free-floating exchange rate system, or to the adoption of another country's currency (e.g. the adoption of the US dollar in Ecuador in 2001),[7] or to the creation of a single currency in a monetary union, as in Europe.

[7] Central Intelligence Agency, The World Factbook (see: https://www.cia.gov/library/publications/the-world-factbook/geos/ec.html).

CHAPTER 2:
USES

The history of gold dates back to at least 5,000 years ago, and demand for it has been expanding continuously in both quantity and types of uses.

In recent times, after a sharp slowdown of world demand from 2000 to 2003 (by 25 per cent), the demand for gold started to rise again between 2004 and 2007. On average, 2,900 tons were traded annually during this latter period. In 2008, as a result of the global financial and economic crisis, demand for gold accelerated, reaching 4,515 tons in 2011 and later peaking at 5,042 tons in 2013. In 2014, demand declined by 17.5 per cent, to 4,159 tons (figure 3).

Demand for gold mainly results from a combination of purchases made for (1) jewellery fabrication, (2) industrial purposes, (3) investments in the form of bars and coins, exchange traded funds (ETFs) or similar products, and, (4) net sales by central banks. The historical background of these various sectors and subsectors that have been the source of global demand for gold since the beginning of the 2000s is discussed below, as well as potential developments in the years to come.

1. JEWELLERY

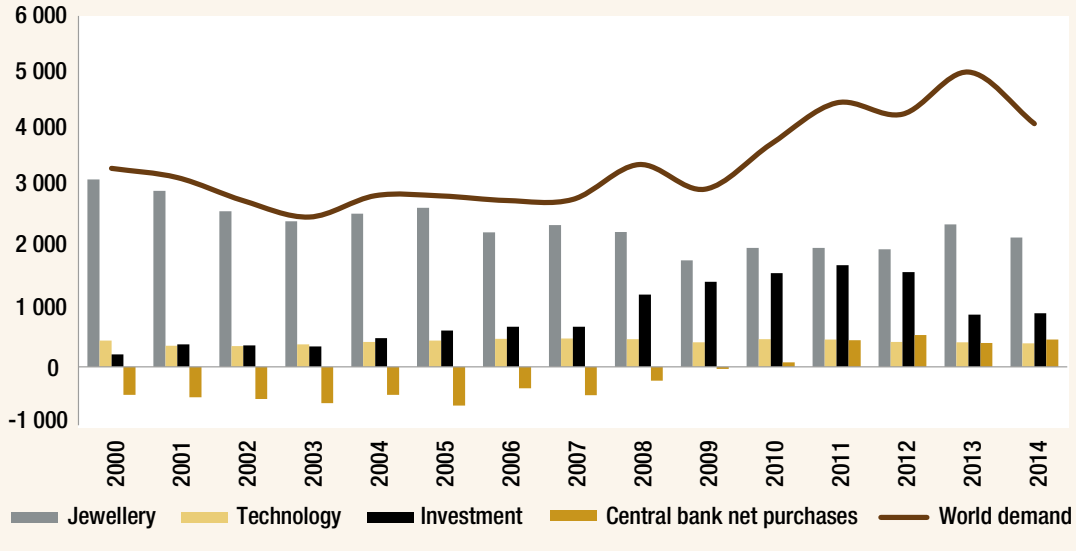
Since the discovery of gold, it has mainly been used for making jewellery. Traditionally, gold has been highly appreciated for its lustre, resistance to tarnishing and corrosion, and its malleability and ductility, which allow it to be crafted into various shapes. Moreover, thanks to its scarcity and globally recognized beauty, it is highly valued in the production of objects used in special events, such as wedding rings. But gold is also used for the production of religious items and for the fabrication and restoration of artistic objects (e.g. gold leaves).

For jewellery, gold can be used in its pure form. However, because of its softness, it is often alloyed with other metals, such as silver and copper. Although these alloys are less resistant to tarnishing, they are also less expensive than pure gold. A standard of trade known as "karatage" has been developed to define and harmonize the gold content of alloys. Pure gold of 24 karats (a ratio of 24 out of 24) is the benchmark, whereas an alloy containing 75 per cent of gold is said to be 18 karat gold (18 out of 24). The preferred karatage varies by country. For instance, in France, 18 karats is the reference for jewellery made of gold, while 22 karats and 14 karats are used more in India and the United States respectively.

In some developing countries where a large proportion of the population does not have easy access to the financial and banking system, gold is often used as a means of storing value, preserving wealth and passing down savings to heirs. For this reason, falling gold prices can have a direct negative impact on vulnerable local populations.

Between 2005 and 2014, jewellery remained by far the largest gold-consuming sector, accounting for

Figure 3. Historical evolution of world demand for gold, and distribution of the demand by sector, 2000–2014 (tons)

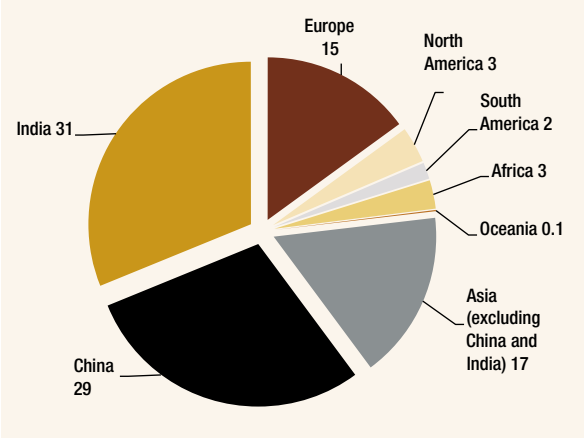


Source: UNCTAD secretariat based on Thomson Reuters Eikon (accessed 8 April 2015).

56 per cent of total world demand, though this was a significant decline from the year 2000, when it accounted for 84 per cent.

In recent years, demand for gold for jewellery has been mainly concentrated in Asia (figure 4), with China and India in the lead. Their combined share in world demand has nearly doubled during the past decade (from 32.1 per cent in 2005 to 60 per cent in 2014).

Figure 4. Demand for gold by jewellery sector: geographical distribution, 2014 (per cent)



Source: UNCTAD Secretariat based on Thomson Reuters Eikon.

India has been the major gold-consuming country in the last 10 years, accounting for more than a quarter of world demand. However, by 2014, China had become the major market for gold for jewellery following a massive growth of demand there (by 168 per cent) between 2005 and 2014, mainly driven by the expansion of the country's middle class.

The 2008–2009 financial and economic crises in Europe and the United States led to a sharp slump in their demand for gold in the jewellery sector. Despite some recovery of the sector in 2013 and 2014, demand has fallen more than twofold since 2005. This drop may be explained by a combination of economic uncertainty, more risk-averse attitudes by local populations and a contraction in the share of income spent on the purchase of jewellery made of gold.

The use of scrap for gold jewellery fabrication has followed two different patterns in Europe and the United States on one hand, and China and India, on the other. Scrap represented 28.3 per cent and 45.6 per cent, respectively, of the total demand for jewellery in Europe and the United States, while it accounted for about 15 per cent of total gold demand for jewellery in China and India.

In the coming years, the demand for gold for jewellery is expected to recover slowly in Western countries, mainly mirroring the recovery of United States and European economies. With regard to Asian countries, that demand, which is already strong, is expected to continue to rise, supported by demographic factors (e.g. population growth and an expanding middle class) and a positive economic outlook. In China and India, for instance, the population is estimated to grow by 3.7 per cent and 9.6 per cent, respectively, between 2013 and 2020, while their GDP per capita (in current US dollars) is forecast to rise by 74 per cent and 68 per cent, respectively, over the same period, according to data from the International Monetary Fund (IMF).

2. INDUSTRIAL USES

Industrial applications consumed 450 tons of gold, accounting for an average of 12 per cent of the global demand for gold over the last decade (2005–2014). This share remained stable over the period, mainly driven by the electronics (76.8 per cent) and dentistry (12.2 per cent) sectors.

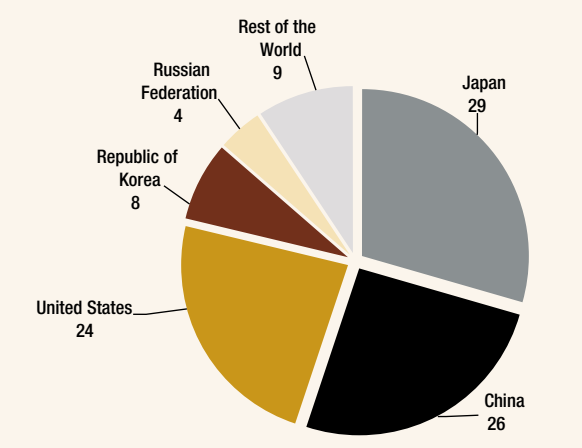
a. Electronics

As a good electrical conductor and highly resistant to corrosion, gold is largely used in the production of electronic and electrical components such as connectors, bonding wires, printed circuits, electrical contacts and semiconductors.

Electrical and electronic applications consumed 280 tons of gold in 2014, a contraction of around 16 per cent compared with the peak of 333 tons in 2010. Between 2010 and 2014, the market was driven by two main opposing forces: despite some temporary turbulence, the final high-tech devices sector remained buoyant and contributed to supporting gold demand, whereas the increasing move towards alternatives to gold, notably to copper and palladium-coated copper applications in the bonding wires sector, led to a contraction of the demand for gold in this sector. This downward trend was strengthened by a contraction of demand from the semi-conductor sector (by 4.1 per cent between 2010 and 2012). Nevertheless, this latter sector recovered to its pre-crisis level in 2013.

For the last 10 years (2005–2014), the five leading consuming countries contributing to about 86 per cent of this total sectoral demand were, in order of importance, Japan, China (including Taiwan Province of China), the United States, the Republic of Korea and the Russian Federation (figure 5).

Figure 5. Demand for gold by electronics sector: geographical distribution, 2014 (per cent)



Source: UNCTAD Secretariat based on Thomson Reuters Eikon.

The geographical distribution of this demand has been driven mainly by the large increase in demand from China, which almost doubled over the past decade, primarily fuelled by the expansion of its domestic market. The evolution of demand in other major consuming countries followed different patterns with, for instance, a rise of 1.6 per cent in the United States, despite economic and financial turmoil, and a contraction of demand in Japan and the Republic of Korea, of 26.6 per cent and 23.6 per cent respectively.

The demand for gold in electronics is expected to continue to contract, possibly by more than 15 per cent by 2018, mainly as a result of the trend towards the adoption of substitutes for gold, principally in the bonding wire sector. [8]

b. Dentistry

Owing to its "longevity, functionality, aesthetics, and biocompatibility, together with ease of manufacture" (Knosp et al., 2003), pure or alloyed gold has been used in dentistry for a long time. It is used for direct fillings and for the fabrication of crowns or dental bridges, for instance.

Unlike the general trend in other sectors, demand for gold in dentistry appears to be driven mainly by demand in developed countries, which accounted for an average of 85 per cent of the world gold demand in the sector during the last 10 years.

As a result of the development of cheaper substitutes to gold (e.g. ceramic, cobalt/chrome alloys, porcelain), the share of dentistry has been declining since 2005, when this sector accounted for about 14 per cent of total technological uses, and the forecast to 2018 shows a continued declining trend.

Apart from the main industrial sectors reviewed above, gold is also used in some other sectors, notably in the aerospace industry, where it is highly appreciated for its property of being highly reflective to infrared radiation. In the automotive sector, gold has increasing potential in the production of catalytic converters, for instance; it is also used in various medical applications.

3. GOLD AS AN INVESTMENT VEHICLE

Investments in gold take two main forms: physical investments in bars and coins, and trading in exchange-traded funds (ETFs) and similar products.

a. Physical bars and coins

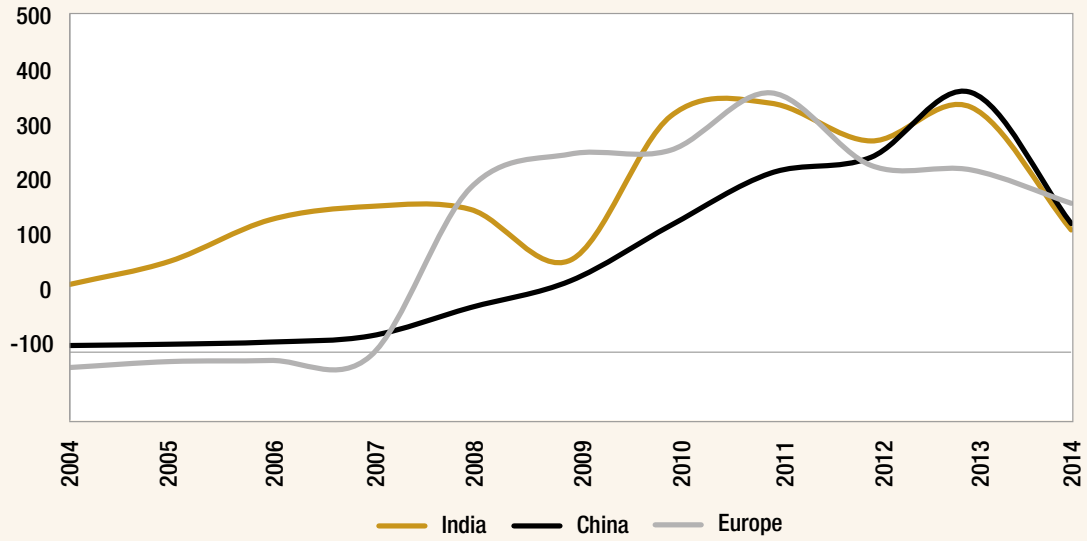
Gold has been used as an instrument for storing value for centuries. The first specimen of a coin made of gold dates back to the Lydian kingdom and its famous king, Croesus (560–547 BC). Thanks to its fungibility, its high value-to-weight ratio and its resistance to corrosion, among others, gold has been extensively used for minting coins throughout history. However, the introduction of paper money marked the beginning of the abolishment of gold coins. Thereafter, the use of gold has been mainly limited to the production of coins and bars for investment or collection purposes.

Over the period 2005–2013, investments in gold bars and coins accounted for about 64 per cent of world investments in gold. Apart from declines in 2009 (of 16.9 per cent) and in 2012 (of 15.5 per cent), investments in gold bars regularly increased, recording an average annual growth rate of 22 per cent. The largest change occurred at the beginning of the 2008 economic crisis, with demand more than doubling from 2007 to 2008. This trend mainly resulted from gold generally being considered a safe haven during periods of economic and financial uncertainty. Indeed, gold can be kept for a long period of time without deterioration. As a consequence, it is seen as an attractive investment, despite its high opportunity costs. Physical investments in bars and coins remained high up to 2013, when they reached their largest purchased volume of 1,772 tons.

During the period 2005–2013, demand from India and China mainly followed an upward trend (figure 6), with an annual average of 254 tons and 150 tons respectively. In China, gold investments were largely

[8] Thomson Reuters Eikon, Three-Year Outlook for Gold, 27 October 2015.

Figure 6. Investments in gold bars, by weight, in China, Europe and India, 2005–2014 (tons)



Source: UNCTAD secretariat, based on World Gold Council (various).

a response to expectations of domestic inflation, combined with the lack of attractiveness of other types of investments.

The trend of world demand for investments in gold bars reversed in 2014, with a large drop of 40 per cent from the previous year.

Investments in gold bars were also significant in Europe over the period 2005–2014. Prior to 2007, the general trend in Europe was mainly towards large disinvestments in physical gold. However, this trend reversed in 2008 with the beginning of the economic and financial crises. Thereafter, European demand for bars rose to a peak of 303 tons in 2011, but started to decline the following year. Nevertheless, the demand for bars and coins in this region remains high compared to its historical levels.

b. ETFs and similar products[9]

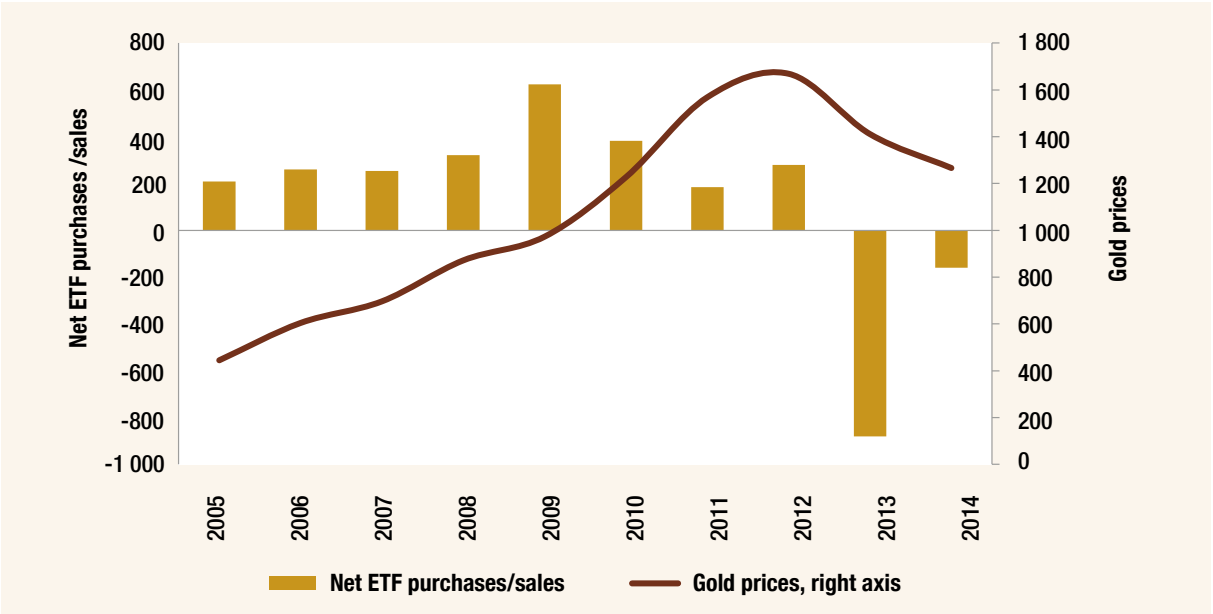
ETFs are funds that track indexes where shares represent a portfolio which tracks the yield and return of its native index. ETFs have been in use since the beginning of the 1980s, and are mostly traded in Europe and the United States.

With the 2008–2009 economic and financial crisis and the European sovereign debt crisis, investments in ETFs and other related products almost doubled, pushing world demand for gold to 623 tons in 2009, compared with 321 tons in 2008 (figure 7). In 2010, fund managers began to adopt a new strategy due to historically high gold prices. As a result, volumes invested in ETFs fell to their pre-crisis level, accentuated by a fall in gold prices in 2013.

Investments in ETFs are expected to continue their 2014 trend as long as the future of the world economy remains uncertain. Depending on whether investors follow short-term or longer term strategies, two scenarios for demand for gold could be envisaged. Short-term market players may divert part of their gold investments to other financial instruments which may appear more attractive based on the premise of economic recovery in the United States and the strategy adopted by the United States Federal Reserve to progressively increase its interest rates, which started with a rise of 0.25 per cent on 16 December 2015. However, for long-term investors, the current level of gold prices may discourage them from liquidating their positions, as they would suffer losses. On the other hand, the current low level of gold prices compared to their recent peaks may also encourage new investors to enter the market in the hope of making profits.

[9] Exchange traded funds and similar products, include, but are not limited to, SPDR Gold Shares, iShares Gold Trust, ZKB Gold ETF, ETFS Physical Gold/Jersey, Gold Bullion Securities Ltd, Central Fund of Canada Ltd, Xetra-Gold, Julius Baer Precious Metals Fund – JB Physical Gold Fund, Source Physical Gold P-ETC, Sprott Physical Gold Trust (World Gold Council, Gold demand trends, first quarter 2015, May 2015; available at: http://www.gold.org/supply-and-demand/gold-demand-trends).

Figure 7. Net ETF purchases (tons) and gold prices (dollars per troy ounce), 2005-2014



Source: UNCTAD secretariat based on Thomson Reuters Eikon for net ETF purchases, (accessed 20 May 2015) and UNCTADstat for gold prices.

4. NATIONAL GOLD RESERVES AND PURCHASES OF GOLD BY CENTRAL BANKS

With 31,927 tons of gold stocks worldwide in 2014,[10] central banks held about a fifth of the total gold extracted worldwide since its discovery.

Between 1948 and 2014, the quantity of gold held by central banks globally increased by 6 per cent, with a peak recorded at 38,219 tons in 1965. From 1965 to 2007, central banks' gold reserves gradually fell, reaching their lowest level at 29,864 tons in 2007. Thereafter, their global stocks rose again following the economic and financial turmoil which pushed the central banks to diversify their portfolios away from dollars and euros. This generated an increase of about 7 per cent between 2007 and 2014 in central banks' gold reserves.

Since 1980, the tonnage of gold stocks held by the 10 leading countries has been increasing (figure 8). While they accounted for 59 per cent of total gold holdings in 1980, their aggregate share amounted to 68 per cent in 2014. The largest national gold reserves were held by the United States, followed by Germany, Italy, France and the Russian Federation, which together accounted for more than half of total world gold reserves in 2014. However, the share of their national central banks' gold reserves in total central bank reserves differs: those of the Russian Federation accounted for 13.3 per cent of the total in 2014, compared with more than two thirds held by the central banks of the United States, Germany, Italy and France. In these countries, the large stocks of gold held by central banks mainly represent a legacy from the former gold standard system.

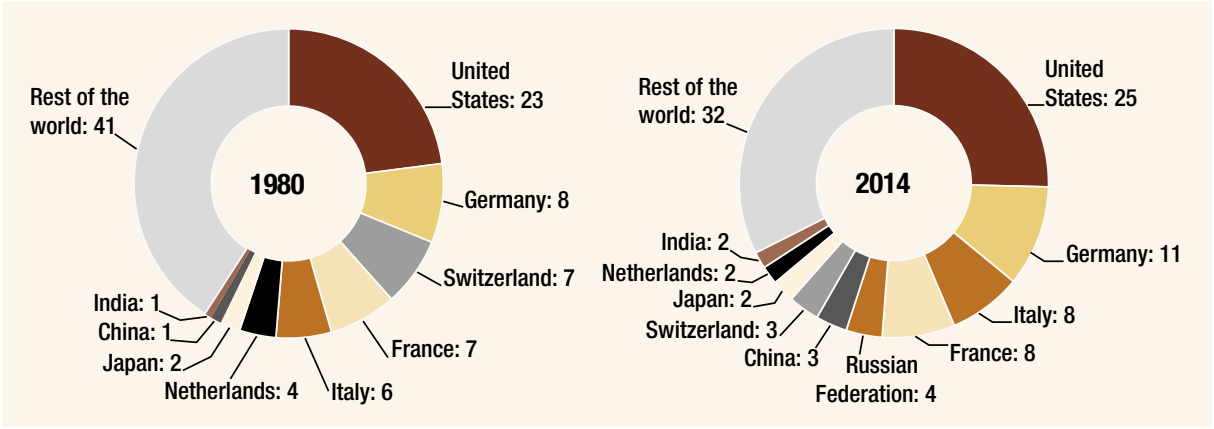
Apart from the effect of the physical stocks of gold held by central banks on gold prices, central banks can also have short-term impacts on gold prices through their purchases or sales of gold.

After 21 years of net sales, central banks became net buyers of gold in 2010 (figure 9). During the period 1989–2009, and apart from a few years when sales by central banks were more limited (20–30 tons),[11] volumes sold by them averaged 420 tons a year. The move towards net purchases of gold by central banks was mainly due to a combination of two factors: the large increase of purchases from emerging market economies' central banks and the global contraction of sales in other countries, particularly signatories to central bank gold agreements. From 2010 to 2014, central banks purchased an average of 391 tons, which was about 15 per cent of world annual mine

[10] IMF (accessed 7 April 2015).

[11] Namely 1990, 1991, 1996, 2009.

Figure 8. Central banks of countries with the largest gold reserves, as a percentage of total world gold reserves held by central banks, 1980 and 2014 (per cent)



Source: UNCTAD secretariat based on the IMF.

Note: IMF gold stocks are not included either in these graphs or in the analysis that follows.

production over the period. This trend started to decelerate in 2013 with the increasing volatility of gold prices, and is expected to continue up to 2018, when net purchases are forecast to fall to 100 tons.[12]

Central banks' interventions in the gold market through buying and selling of gold and their release of information on their gold holdings may have a direct impact on gold prices through supply and demand, and an indirect impact through the resulting strategies by other actors in the gold market. In this regard, central banks' interventions may also have an impact on the valuation of gold companies as well as ETFs.

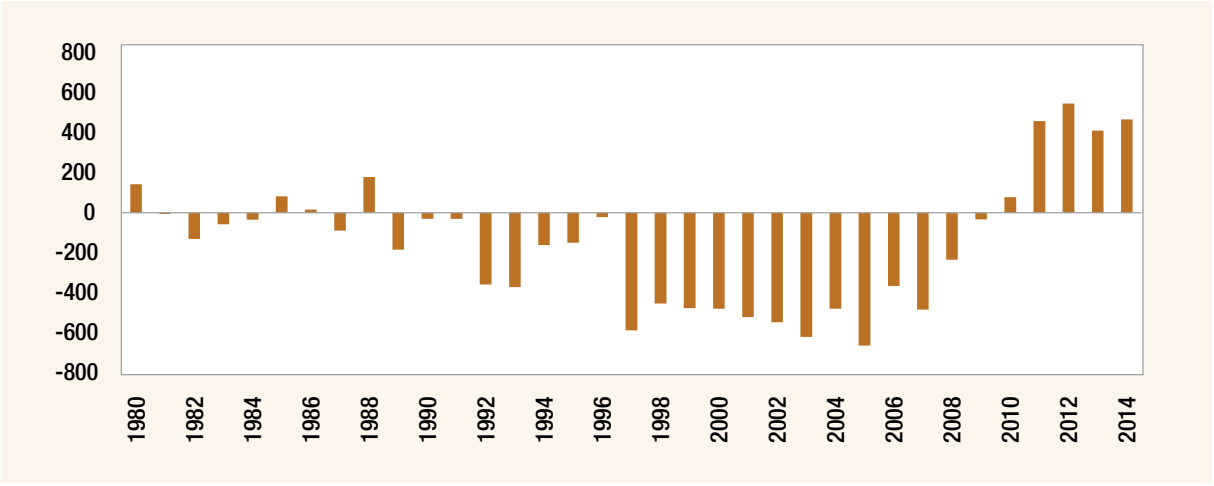
[12] Thomson Reuters Eikon, Three-year outlook for gold, 27 October 2015.

Even though the role of central banks in the gold market is acknowledged to be potentially important, the trend in gold prices since 2008 is mostly attributed to the evolution of the dollar as well as macroeconomic factors, such as concerns regarding potential inflationary risks. Since 2012, with a slight improvement in the global economic situation and the strengthening of the dollar investors may have been induced to acquire more liquid and remunerative assets, leading to a drop in gold prices.

a. Purchases made by central banks of emerging market economies

Since the beginning of the 2000s, the central banks of Bangladesh, China, India, Iraq, Kazakhstan, the

Figure 9. Net purchases of gold by central banks, 1980–2014 (tons)



Source: UNCTAD secretariat, based on World Gold Council (various).

Table 2. Trends in real GDP growth and gold reserves in emerging market economies, 2000–2014 (per cent and tons)

Country	Real GDP growth 2000–2014 (per cent)	Gold reserves in 2000 (tons)	Gold reserves in November 2015 (tons)	Change in gold reserves 2000–November 2015 (per cent)	Gold as a percentage of total central bank reserves November 2015 (per cent)
Russian Federation	75	379	1 352	257	13.1
China	243	395	1 709	333	1.6
Thailand	72	73	152	108	3.5
Bangladesh	113	3	14	367	1.9
India	141	358	558	56	5.6
Kazakhstan	165	57	214	275	27.2
Iraq	74	6	90	1 400	4.8
Mexico	31	8	122	1 425	2.4
Republic of Korea	63	14	104	643	1.0
Turkey	68	116	505	335	15.2

Source: UNCTAD secretariat, based on UNCTADstat (for real GDP) and World Gold Council (for gold reserves and official gold holdings, accessed 21 May 2015).

Republic of Korea, Mexico, the Russian Federation, Thailand and Turkey, among others, increased the quantity of gold they held in their national reserves (table 2). However, in spite of the absolute increase in their gold stocks, the share of gold in their total reserves declined as a result of a larger increase in their foreign-currency-denominated assets. For example, while the share of gold in total Russian reserves dropped from 25 per cent to 5 per cent between 2000 and 2010, Russia's merchandise export value increased nearly fourfold over the same period.

At the same time as the demand from central banks in emerging market economies tended to increase, gold sales from central banks in developed countries, mainly Europe, tended to contract in response to expectations of a sovereign debt crisis in Europe and the adoption of low-risk strategies by European central banks. This new approach added to the position already taken by central banks in European countries to limit their gold sales within the framework of the Central Bank Gold Agreement (CBGAs).

b. Reduction of gold sales by signatories to the Central Bank Gold Agreements

Between 1980 and 1999, gold lost 54 per cent of its value. Fearful of a potential depreciation of the real value of their gold reserves, many of Europe's national central banks, as well as the European Central Bank and the Swiss National Bank joined forces to stabilize the gold market through a coordinated control of their sales. To this end, they signed the first CBGA in 1999, also known as the Washington Agreement on Gold, whereby they agreed to limit their gold sales to 400 tons annually and up to a maximum of 2,000 tons for the five-year period of the Agreement.[13] The central banks also highlighted the need to keep gold as an important asset in their national reserves in the future.

In 2004, at the time of the signature of the second CBGA, gold prices had already increased by 47 per cent compared with their average in 1999. This second agreement raised the upper limit of annual and five-year gold sales to 500 tons and 2,500 tons, respectively.[14] The Bank of Greece joined the agreement in 2004, while the Bank of England left it the same year. The central banks of Cyprus and Malta joined in the course of the agreement in 2008.

The third CBGA, signed in 2009, sought to restore maximum gold sales to their 1999 levels.[15] The Agreement also acknowledged the intent of the IMF to sell some of its gold reserves (403.3 tons).

[13] ECB (1999). Joint statement on gold. Frankfurt am Main, 26 September. Available at: https://www.ecb.europa.eu/press/pr/date/1999/html/pr990926.en.html.

[14] ECB (2004). Joint statement on gold. Frankfurt am Main, 8 March. Available at: https://www.ecb.europa.eu/press/pr/date/2004/html/pr040308.en.html.

[15] ECB (2009). Joint statement on gold. Frankfurt am Main, 7 August. Available at: https://www.ecb.europa.eu/press/pr/date/2004/html/pr040308.en.html.

The fourth CBGA signed in 2014 confirmed the importance of gold for signatories' central banks.[16] However, it set no specific limits on gold sales, most probably due to the difficult economic situation in Europe. Stakeholders reaffirmed the importance of avoiding large gold price swings, and expressed their intention not to sell large quantities of gold during this five-year Agreement. The next CBGA is planned to be concluded in 2019.

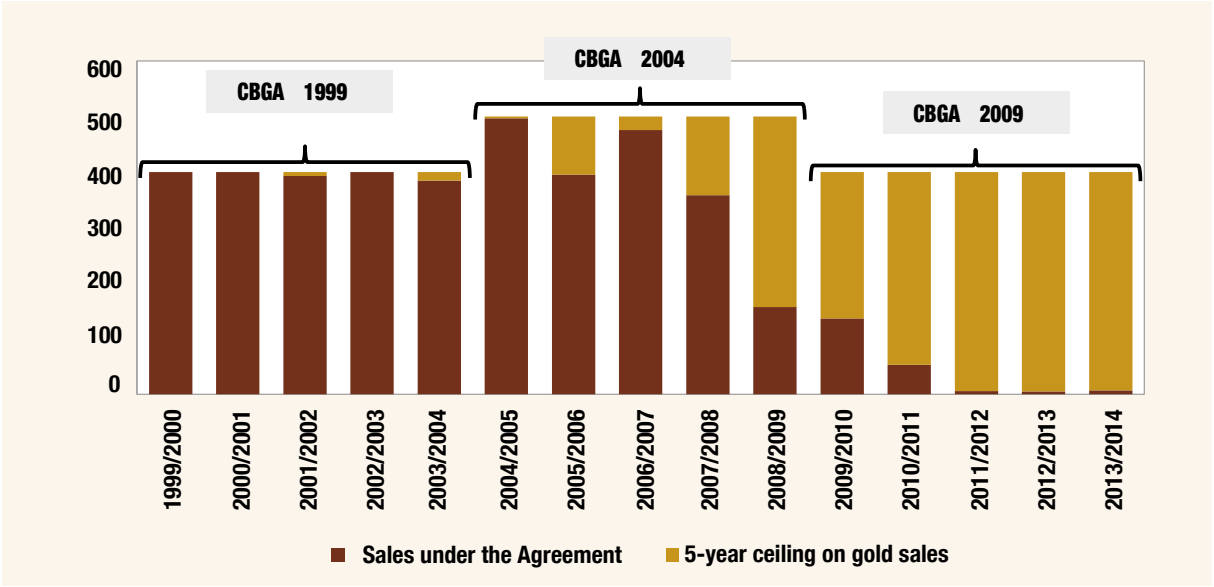
Over the past decade (2004–2014), central banks sold, on average, 210 tons of gold per annum (5 per cent of the world gold supply). This average fell to just over 40 tons between 2009 and 2014, possibly because the European Union (EU) did not wish to send a wrong signal to financial markets by selling large quantities of gold from its reserves so as to avoid further weakening countries that were experiencing a difficult economic situation. Moreover, proceeds from selling gold from the national reserves of the most indebted European countries would not have been sufficient to overcome their high level of indebtedness (figure 10).

[16] ECB (2014). ECB and other central banks announce the fourth Central Bank Gold Agreement. 1 Frankfurt am Main, 9 May. Available at: https://www.ecb.europa.eu/press/pr/date/2014/html/pr140519.en.html.

Jewellery, which, as noted, accounts for the largest share of world demand for gold since the discovery of gold, plays a historical and pivotal role in the gold market. In this context, demands from China and India are particularly important indicators of the global state of the gold sector. This situation is not expected to change in the coming years, as the jewellery sector may gain about 10 per cent by 2018.[17] Moreover, gold has been playing a growing role in the financial sector, both through the physical demand for coins and bars, and through financial transactions on international markets. This is because of its capacity to store value for a long period of time thanks to its inalterability, its role as a safe haven in periods of crisis and the development of innovative financial tools. Moreover, in periods of increasing economic uncertainties, such as during the 2008-2009 financial and economic crisis, the share of gold as a financial instrument gains in importance and tends to have a greater impact on gold prices. This aspect of the demand for gold, which is expected to gain in importance by 2018, will exert upward pressure on gold prices.

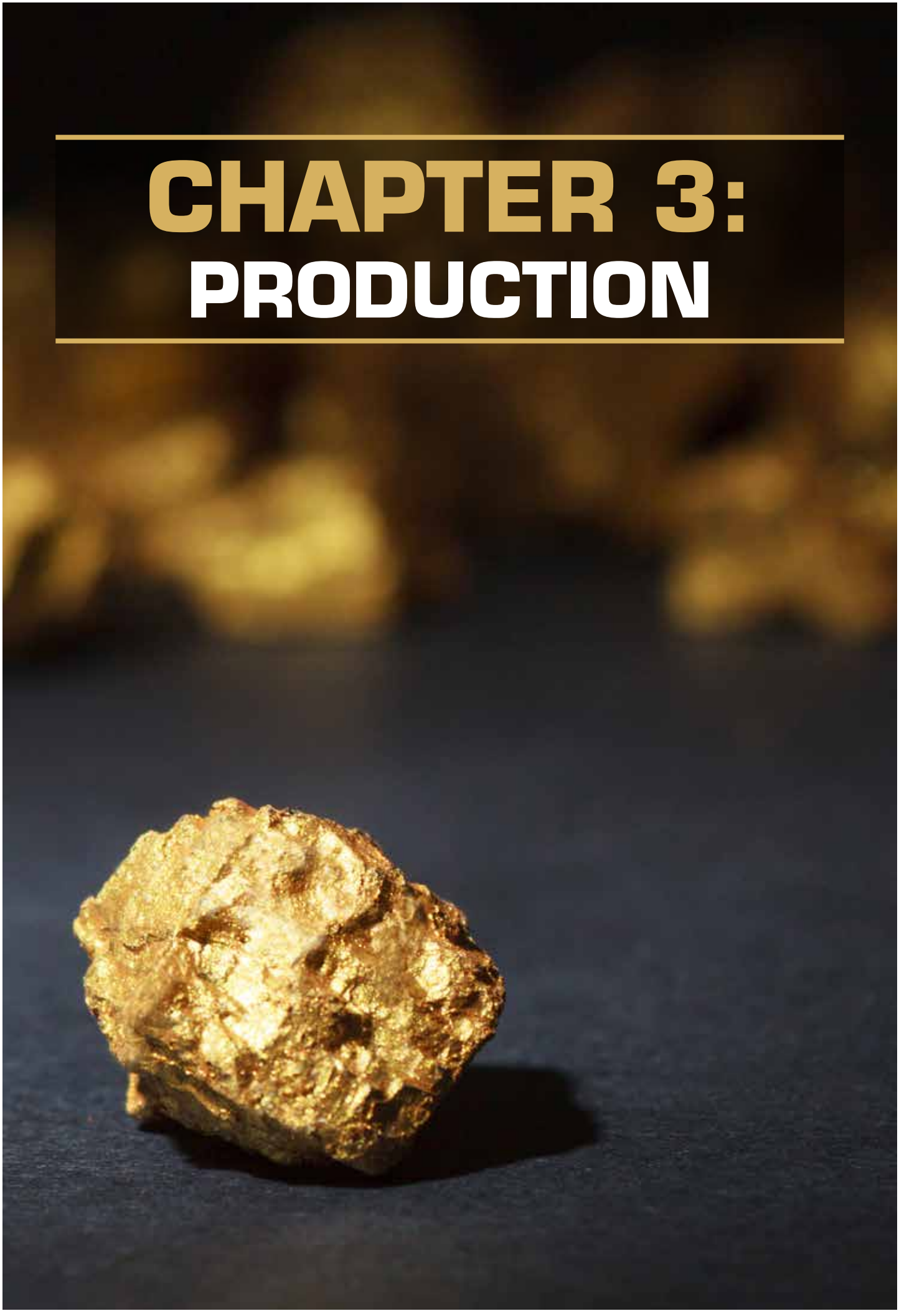
[17] Thomson Reuters Eikon, Three-year outlook for gold, 27 October 2015.

Figure 10. Gold sales under successive Central Bank Gold Agreements, 1999–2000 to 2013–2014 (tons)



Source: UNCTAD secretariat based on the IMF.

CHAPTER 3:
PRODUCTION



According to the World Gold Council, annual world gold supply reached a historical peak of 4,477 tons in 2012. It is essentially supplied from two main sources: gold mine production – also called primary production – which accounts for about two thirds of world supply; and the recycling of gold – also known as secondary production – which accounts for the remaining one third.

1. TECHNICAL ASPECTS OF GOLD PRODUCTION

a. Primary gold mining

Primary gold can be extracted from (i) veins and lodes, which are primary bedrock deposits, and (ii) placers, which result from the action of weathering on original lode deposits.

i. Primary deposits: Veins and lodes mining

With about 90 per cent of all gold extracted worldwide, lodes and veins mining is the main source of annual primary production of gold in the world. In lodes, gold is mainly present in quartz-pebble conglomerate deposits (56 per cent of annual world gold production). But gold may also be extracted from other types of veins (table 3) and as a by-product in the extraction of base metals (e.g. copper, lead and zinc, nickel) or other precious metals such as silver.

The average grade recovered largely varies from one mine to the other, ranging from less than 1 gram per ton to 19.62 grams per ton in Turquoise Ridge (United States) in 2014, for instance.[18] The gold content of a deposit is one of the main aspects determining the choice of mining and recovery methods.

[18] See appendix 2: The state of gold mines around the world, 2015.

Table 3.	Gold ore types
1.	Placers
2.	Quartz vein-lode ores
3.	Oxidized ores
4.	Silver-rich ores
5.	Copper sulfide ores
6.	Iron sulfide ores
7.	Arsenic sulfide ores
8.	Antimony sulfide ores
9.	Bismuth sulfide ores
10.	Telluride ores
11.	Carbonaceous - sulfidic ores

Source: SGS minerals

Gold can be extracted from underground or open-pit mines. Usually, the open-pit method is used to recover low-grade gold (less than 4 grams per ton), while underground mining is preferred for extracting high grade materials, as this technique is generally more costly.

ii. Secondary deposits: Placer mining

Placer deposits result from the long-term action of a set of natural factors (e.g. wind, gravity, water, waves and glaciers). These elements progressively erode the original gold lode deposits and mother rocks, leaching gold ores away from their gangue, and transporting and depositing them away to a different place. In this case, deposits are known as alluvial, fluvial or marine deposits. However, gold particles may also remain more or less in-situ. In this case, deposits are called elluvial. In placer deposits, such as flood plains, stream beds or oceans, gold mainly appears in its native form (e.g. dust, flakes or nuggets). According to the United States Geological Survey (USGS), placer deposits were the main source of gold production in the past, contributing to around 90 per cent of the world production from 1850 to 1875 (Butterman, WC and Earle, 2005). However, placer deposits have become less important today, mainly due to the development of veins and lodes mining worldwide.

Placer gold is mainly separated from the sand and gravel by gravity, sluicing or panning separation techniques. These methods, which rely on the high density of gold (19.32 grams per cubic centimeter (g/cm^3)) compared with other surrounding rocks (around 2.6 g/cm3), are used when particles are bigger than 75 micrometres (µm). Once recovered, the ore containing gold particles is reduced to dust. The sand is then put into a jig which uses a stream of water to extract gold and produce the concentrate (a mixture of gold, and some remaining small quantities of sand). If sulfide minerals are present, the concentrate is cleared by froth flotation.[19] Thereafter, the processing of gold is the same as for lode and veins mining (see appendix 1).

[19] Froth flotation is a process whereby the ore containing gold particles is finely crushed and mixed with water to produce slurry to which chemical conditioning agents are added to increase its hydrophobicity; the resulting blend is then loaded in agitated flotation cells with water, into which air bubbles are injected. Under the combined effect of chemical agents and the agitation, the air bubbles capture the gold contained in the slurry and bring it to the top of the cell where the froth is skimmed off. This technique is also used in the treatment of refractory ores.

BOX 1. The use of mercury in gold mining: amalgamation

The use of elemental mercury (Hg) in gold recovery is based on the solubility of gold in mercury. Gold dissolves and forms an amalgam with mercury; hence the term "amalgamation" is used for this operation. The amalgam is then filtered and heated to separate the gold from the mercury. This operation results in the evaporation of mercury in the form of noxious vapours. At this stage, only gold remains, and the mercury can be recovered for reuse.

The World Health Organization (WHO) considers mercury to be one of the top 10 chemicals or groups of chemicals of major public health concern. Mercury can severely affect miners who are directly exposed to it through their inhalation of vapours (80 per cent are believed to pass into the bloodstream). But mercury can also chronically contaminate surrounding communities through dust and vapours transported by the wind or through residues on clothes or walls, for instance. According to WHO, "Recent studies suggest that mercury may have no threshold below which some adverse effects do not occur."[a] However, the official limit has been set at 1,000 nanograms.

If mercury is released into the environment, it can contaminate the entire food chain. Notably, it may metabolize into Methylmercury under the action of anaerobic organisms. In this case, bioaccumulation and sometimes bio-magnification may occur in fish and shellfish, which can dramatically expose local populations and severely threaten the development of young children and fetuses *in utero*.

[a] WHO (2005)

In the past, mercury was widely used for the recovery of gold due to its low cost and ease of use. However, because of its severely harmful effects on humans and the environment (box 1), its use has been largely abolished and remains mostly confined to artisanal small-scale gold mining (ASGM). According to the United Nations Environment Programme (UNEP), ASGM, which accounted for 37 per cent of world mercury emissions in 2013, is considered a major source of air and water mercury pollution (UNEP, 2013a). To deal with this issue, the Minamata Convention on Mercury[20] was adopted in October 2013 under the aegis of UNEP. The general objective of this convention is "to protect the human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds" (article 1 of the Convention). In order to achieve this goal, the convention provides a global framework for the control of the supply and international trade of mercury (article 3) and its uses (articles 4, 5, 6 and 7). Article 7 is specifically dedicated to ASGM activities. Moreover, articles 8 to 12 provide for the monitoring and control and, where feasible, reduction of mercury emissions and releases into the environment. Finally, the Minamata Convention also addresses the issues of mercury storage as well as the management of waste and contaminated sites.

[20] UNEP, Minamata Convention on Mercury, October 2013 (see: http://www.mercuryconvention.org/).

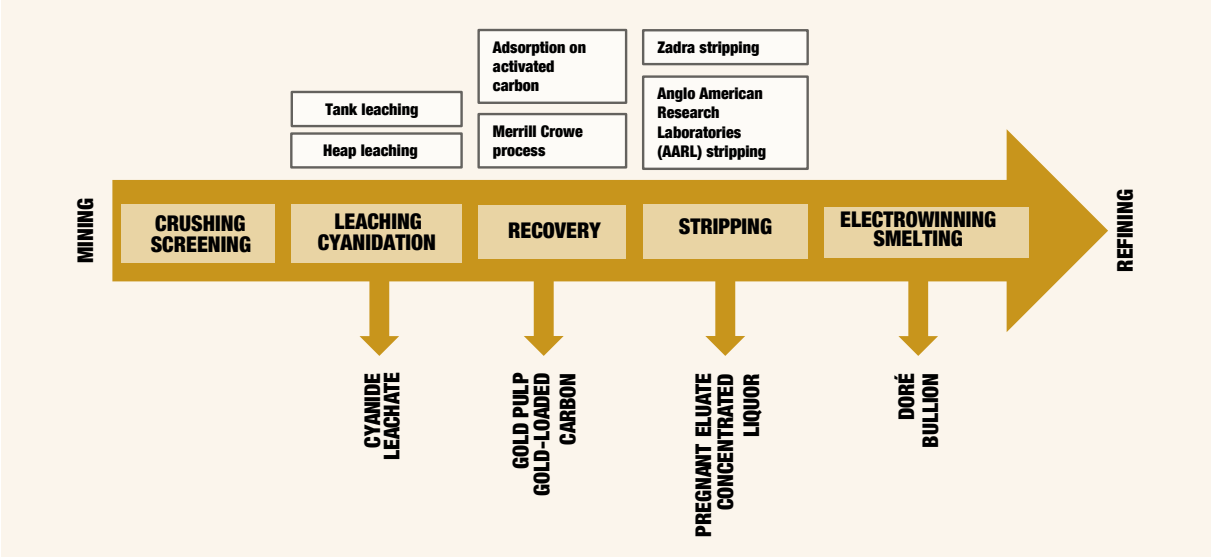
b. The metallurgy of gold

The processing steps presented in figure 11 are a general example applicable to about two thirds of gold processing worldwide. However, it should not be considered applicable to all types of auriferous ores. For example, the combination of cyanidation with complementary treatments would be necessary for the processing of refractory gold ores, as traditional direct cyanidation methods will allow the recovery of only 10–20 per cent of the gold contained[21] in these ores.

The use of cyanide historically has been, and remains, of the greatest importance for gold recovery. However, cyanide is also a highly toxic and rapidly acting poisonous substance. Under certain circumstances, it can have harmful effects on birds, fish and mammals, including human beings. Intoxication by cyanide can occur by inhalation, ingestion or by cutaneous contact, and mostly affects the cardiovascular, respiratory,

[21] Ores are considered as refractories when the gold particles they contain cannot be satisfactorily recovered by standard methods (e.g. direct cyanidation or carbon adsorption processes). As a result, they must be pre-treated by pressure, chemical or bio-oxidation (the latter is also known as bacterial leaching), or roasted in order to allow traditional recovery methods to operate efficiently. Given the extra costs generated by these pre-treatments, this solution is only used to process large quantities of high-grade gold ores. Refractory ores often contain sulfide minerals (e.g. pyrite, arsenopyrite).

Figure 11. The metallurgy of gold



Source: UNCTAD secretariat.
Note: For further information about the metallurgy of gold, see appendix 1.

central nervous and endocrine systems. Cyanide, even at low concentration rates, can also be fatal.

Taking into consideration the possible impacts of cyanide on living beings, both public authorities and the industry have taken steps to improve cyanide-related practices. First of all, as a result of the dramatic Baia Mare (Romania) cyanide spill in 2000, the gold industry elaborated the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold under the auspices of UNEP and the former International Council on Metals and Environment. The code covers numerous aspects of the life cycle of cyanide (e.g. use, transportation, handling, storage, treatment). It also aims to encourage the responsible production of cyanide. [22]

In Europe, the main regulation dealing with this problem is the European Commission's Directive 2006/21/EC on the management of waste from the extractive industries, which stipulates that the concentration of cyanide and cyanide compounds in tailings ponds should be reduced to the lowest possible levels, using best available techniques. Apart from this directive, there are general worldwide efforts towards tighter controls of cyanide-leaching activities. Some countries (e.g. Argentina, the Czech Republic, Greece and some states in the United States) have already banned the use of cyanide leaching techniques in the gold industry

2. STATISTICS RELATING TO GOLD PRODUCTION

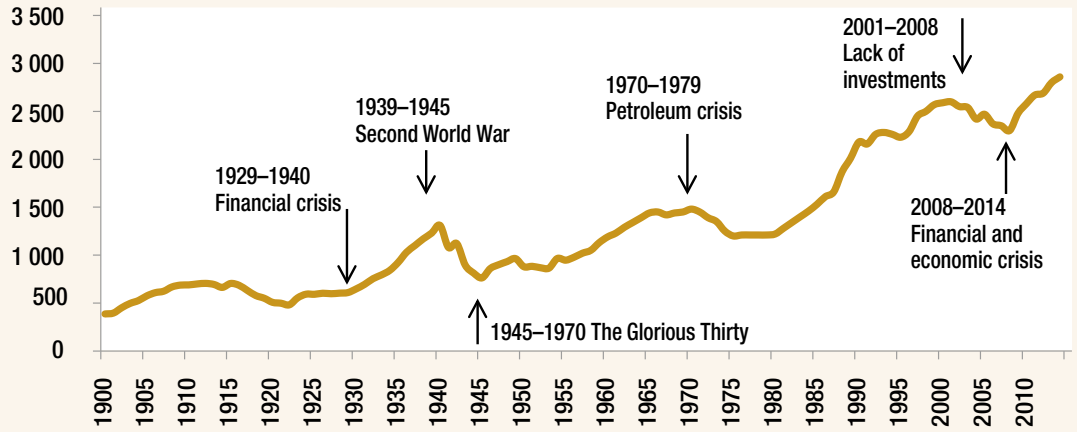
a. Global gold production

Gold can be extracted from large mines or by means of artisanal mining activities, also known as small-scale mining. While accounting for a substantial share of annual gold production, artisanal mining is hard to evaluate and monitor due to the lack of comprehensive data, as related operations are often not registered or are illegal in several countries. As a consequence, this report concentrates mainly on statistical information available for large mine production. (See box 2 for a brief discussion of artisanal mining.)

According to data from USGS, around 180,000 tons of gold have been extracted since its discovery, with 9 tons out of 10 mined since the beginning of the California gold rush in 1848. Thanks to its inalterability, and unlike other commodities, gold extracted since the beginning of historical records is generally still in stock today. This stock was equivalent to about 43 years of annual world demand in 2014. According to USGS

[22] International Cyanide Management Code (undated). The Cyanide Code. Available at: http://www.cyanidecode.org/about-cyanide-code/cyanide-code International Cyanide Management Code (undated). Implementation Guidance. Available at: http://www.cyanidecode.org/become-signatory/implementation-guidance.

Figure 12. World primary gold production, 1900–2014 (tons)



Source: UNCTAD secretariat based on USGS supply and demand statistics; available at: http://minerals.usgs.gov/minerals/pubs/historical-statistics/#gold and USGS, Minerals Yearbook, various issues; available at: http://minerals.usgs.gov/minerals/pubs/commodity/gold/.

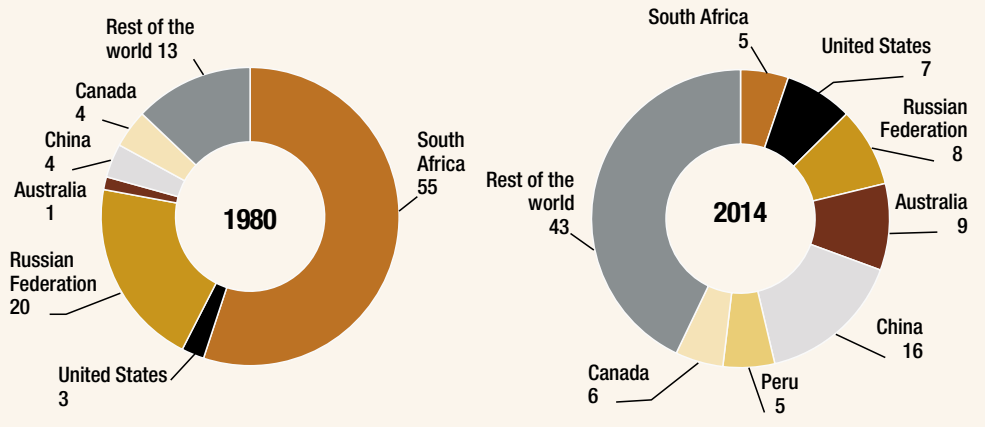
statistics, of the 150,000 tons of gold ores produced since 1900, three quarters were extracted after 1950 (figure 12). Gold production gradually accelerated from 1950 to 1970 and from 1980 to 2000 as a result of growth in demand and the development of new mining and processing techniques which facilitated the exploitation of poorer grade gold deposits. In 2014, the average grade of gold mined was 3.50g/ton.[23]

The recent history of gold production shows a fall of more than 10 per cent between 2000 and 2008. However, gold production started to rise again in 2009, and reached a peak of 2,860 tons in 2014.

[23] UNCTAD computation based on appendix 2 to this report.

Currently, about 90 countries mine gold. Among the leading gold-producing countries, historically, six have been large market players (figure 13). Individually, each of these countries accounted for at least 5 per cent of world production over the period 1980–2014. They are, in order of importance, South Africa (24 per cent), the Russian Federation (10 per cent), the United States (10 per cent), Australia (9 per cent), China (8 per cent) and Canada (6 per cent). Together, they accounted for almost 90 per cent of world production in 1980. However, their aggregated share has been declining over time, from 81 per cent in 1990 to 66 per cent in 2000 and to 56 per cent in 2014. This contraction can be explained by the progressive exhaustion of natural

Figure 13. Shares of leading gold mine producing countries in total world mine production, 1980 and 2014 (per cent)

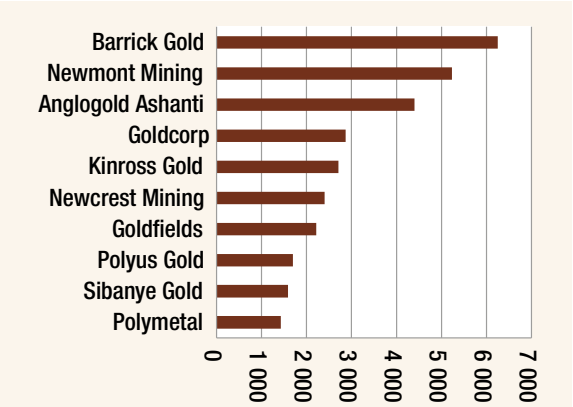


Source: UNCTAD secretariat based on data from the British Geological Survey, 2015.

reserves in these countries, mainly South Africa, as well as the emergence of new market players such as Peru. For example, while Peru was producing 3.8 tons of gold in 1980, its gold production expanded during the 1980s and the 1990s, reaching about 150 tons in 2014.

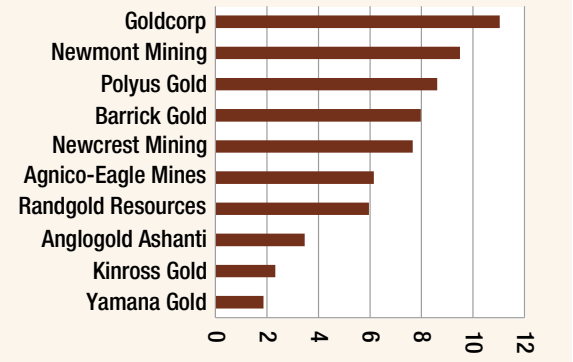
The landscape of world gold production has changed since the beginning of the 1980s, with a trend towards the atomization of gold-producing countries. A major development has been the sharp decline of the share of South Africa in world gold production, from 55 per cent in 1980 to about 5 per cent in 2014. No overwhelming market player can be observed in terms of gold mine production in 2014, in contrast to the past. Today, the main gold-producing country is China with 16 per cent of world gold production, followed by Australia, the Russian Federation, the United States, South Africa, Canada and Peru. In 2014, the combined share of these 7 countries was equivalent to South Africa's share in 1980.

Figure 14a. Ten leading gold companies in terms of gold production, 2014



Source: UNCTAD Secretariat from Annual reports of mining companies.

Figure 14b. Ten leading gold companies in terms of market capitalization, 5 October 2015 (billions of dollars)



Source: UNCTAD Secretariat from Bloomberg.

The concentration of the gold industry is relatively low compared with other mining sectors. The 10 leading gold companies account for around a third of world gold production (figure 14a). They are mainly transnational corporations (TNCs) based in developed countries and in South Africa, but their activities are spread all over the world (appendix 2). Some of these companies are among the biggest in the world, as ranked by Forbes Global 2000 for the year 2014. This is, for instance, the case of Barrick gold (771), Newmont mining (1,033), Goldcorp (1,160), PGL (1,709) and Newcrest (1,922).[24] Together, the 10 leading gold companies recorded about $65 billion in market capitalization, with the three largest accounting for about 45 per cent of this amount (figure 14b).

b. Overview of production in the leading gold-producing countries

i. China

China was the leading gold-producing country for the eighth consecutive year in 2014, with a record 450 tons, representing 15.7 per cent of world gold mine production. China's share in world production has been increasing gradually since 1980, when the country accounted for only 4 per cent of the world's production. It took the lead as the world's top gold producer in 2007, exceeding South Africa's production by almost 10 per cent.

In China, gold is mainly produced in the five Provinces of Fujian, Henan, Jiangxi, Shandong and Yunnan. Gold production remains highly atomized, with the five most productive mines contributing around 10 per cent of annual Chinese gold production. According to various sources, gold in the country is mostly produced by a large number of small-scale companies. Despite a move towards consolidation, the number of producing entities was over 700 in 2010, a decline from 2,000 at the beginning of the 2000s.

[24] The figures in parenthesis indicate the rankings of the companies in Forbes Global 2000 for the year 2014 (http://www.forbes.com/lists/2010/18/global-2000-10_The-Global-2000_Rank.html, accessed 24 February 2015).

Supported by the development of its middle and upper classes, Chinese gold production is mainly consumed locally; in 2013, its revenues from gold exports accounted for a negligible share of total Chinese merchandise export revenues (0.000035 per cent). Underground reserves of gold are low in China – less than 4 per cent of the world total. However, above-ground reserves are comparatively important, especially thanks to stocks held in the form of jewellery. Indeed, China is a large gold-for-jewellery consumer, ranking second after India, with 29 per cent of the world's total in 2014 (see chapter 2 on jewellery above).

ii. Australia

The second largest gold-producing country in the world in 2014 was Australia with 270 tons, representing 9.4 per cent of world production. This country has a long history of gold production, with the first mining operations dating back to the end of the nineteenth century. "In the decade after 1851, Australia produced more than 40 per cent of the world's output of gold" (Minerals Council of Australia, undated). According to USGS statistics, the recent history of gold mining in Australia can be divided into three main periods. Between 1980 and 1997, national production rose from 17 tons at the beginning of the period to a record level of 314 tons in 1997. Thereafter, gold mining operations declined by 32 per cent, falling to 215 tons in 2008. Finally, as a result of a rise in gold prices, the production of gold in the country started to increase again. Between 1980 and 2014, Australia moved up from the sixth to the second rank in terms of world gold production.

Gold production is mainly concentrated in western Australia with 75 per cent of domestic gold production. Most of the gold production is achieved through open pit mines, and is processed and refined domestically. The gold sector directly or indirectly employed more than 50,000 people in 2011 (Minerals Council of Australia, undated).

With a value of about $13.4 billion and more than 5 per cent of its merchandise export revenues in 2013, gold is important for the Australian economy. Moreover, gold was the fourth largest export earner in terms of commodities exported by Australia in 2013 after iron ore, coal and natural gas. Gold is also important for Australia's state and territory government revenues through their collection of taxes and royalties ($300 million in 2011–2012). In addition, the country has one of the largest shares of world underground gold reserves, at about 18 per cent in 2014, according to the USGS.

Table 4. Five leading gold-producing mines in Australia, 2014 (troy ounces)

Mine	Operator	Production, 2014
Boddington	Newmont Mining Corp	696 000
Super Pit	Newmont Mining Corp(50%) / Barrick Gold Corp (50%)	655 000
Cadia Valley	Newcrest Mining Ltd	592 800
Telfer	Newcrest Mining Ltd	536 300
St Ives	Gold Fields Ltd	362 000

Source: UNCTAD secretariat based on the annual reports of the gold mining companies.

Note: All-in sustaining costs (2014): $853 per troy ounce (average computed by UNCTAD from appendix 2 of this report).

iii. Russian Federation

The third largest gold-producing country in 2014 was the Russian Federation. Production is largely concentrated in the eastern part of the country, mainly in the Amur, Irkutsk, Khabarovsk, Krasnoyarsk, Magadan and Sakha (Yatukia) regions. Gold production was high in 2014 compared to its historical average (i.e. 21 per cent higher than the 1980–2014 average). However, its share in world production declined sharply from one fifth of world production recorded in 1980. In the Russian Federation, although gold recorded the sixth largest commodity export earnings in 2013, its share in the country's total merchandise exports was marginal, at less than 1 per cent.

Table 5. Five leading gold-producing mines in the Russian Federation, 2014 (troy ounces)

Mine	Operator	Production, 2014
Kupol and Dvoinoye	Kinross Gold Corp	751 101
Olimpiada	Polyus Gold International	726 000
Blagodatnoye	Polyus Gold International	394 000
Pioneer	Petroplavlosk Plc	319 900
Albazino	Polymetal International Plc	227 000

Source: UNCTAD secretariat based on the annual reports of the gold mining companies.

Note: All-in sustaining costs (2014): $865 per troy ounce (average computed by UNCTAD from appendix 2 of this report)

iv. United States of America

The United States was the fourth major gold-producing country in 2014 with 211 tons produced, representing a share of 7 per cent of the world total.

The United States holds an important place in the collective psyche as the country of the original gold rush at the end of the nineteenth century. USGS statistics show that the United States accounted for about

30 per cent of world gold production in 1900. Since then, production decreased until 1980, despite some temporary bursts, such as during the 1929 Depression. From the beginning of the 1980s up to 2000, gold production increased significantly, from 30 tons in 1980 to 353 tons in 2000, but has been declining since then.

Production is mainly concentrated in Nevada, which accounted for about 70 per cent of the country's gold mine production in 2014. In 2013, gold was the second exported commodity by the United States, accounting for 2 per cent of the total merchandise export revenues.

Table 6. Five leading gold-producing mines in the United States, 2014 (troy ounces)

Mine	Operator	Production, 2014
Carlin Complex	Newmont Mining Corp	907 000
Cortez	Barrick Gold Corp	902 000
Goldstrike	Barrick Gold Corp	902 000
Twincreeks	Newmont Mining Corp	389 000
Fort Knox	Kinross Gold Corp	379 450

Source: UNCTAD secretariat based on the annual reports of the gold mining companies.

Note: All-in sustaining costs (2014): $898 per troy ounce (average computed by UNCTAD from appendix 2 of this report.)

v. Canada

Gold production in Canada started in the 1820s. Currently, gold mining in the country occurs mainly in the Provinces of Ontario and Québec. While gold production recorded a significant deceleration from 2001 to 2008 (by 40 per cent), it largely recovered over the subsequent period (2008–2014), reaching 160 tons, or 5.6 per cent of world production in 2014. This recent rise was mainly supported by the return to investments of mining companies after a period of disinvestment prior to 2002.

Table 7. Five leading gold-producing mines in Canada, 2014 (troy ounces)

Mine	Operator	Production, 2014
Red Lake	Gold Corp Inc	414 400
Porcupine	Gold Corp Inc	300 000
Musselwhite	Gold Corp Inc	278 300
Hemlo	Barrick Gold Corp	206 000
Canadian Malartic	Yamana Gold (50 %), Agnico Eagle Limitée (50%)	143 008

Source: UNCTAD secretariat based on the annual reports of gold mining companies.

Note: All-in sustaining costs (2014): $815 per troy ounce (average computed by UNCTAD from appendix 2 of this report.)

Gold export revenues accounted for about 4 per cent of total merchandise export revenues in Canada in 2013 and gold ranked as the third leading commodity exported by the country that year. In 2014, Canadian gold production reached a record level of 160 tons, which propelled the country to the fifth rank in terms of world gold mine production.

vi. South Africa

South Africa was the leading gold-producing country in 1980, with more than half of world gold production. However, this share dropped by more than 75 per cent between 1980 and 2014, as a result of ageing production facilities and high production costs. All-in sustaining costs in South Africa are the highest in the world, at an average of more than $1,100 per troy ounce in 2014,[25] compared with an average annual international price of $1,266 per troy ounce the same year. This large operating cost is mainly explained by the depth of gold mines in South Africa. In 2014, South Africa ranked sixth in terms of world gold production with 150 tons of gold (compared with 675 tons in 1980).

Despite the current crisis in the national gold sector, this commodity remains of highest importance for the South African economy, and accounts for a large share – 5 per cent – of its merchandise export revenues. Indeed, with export revenues of $5 billion, gold was the third largest export earning commodity in 2013. South Africa's domestic gold reserves remain the second largest in the world, representing more than 10 per cent of world reserves in 2014. Moreover, one of the biggest gold companies in the world, AngloGold Ashanti, is South African.

Table 8. Five leading gold-producing mines in South Africa, 2014 (troy ounces)

Mine	Operator	Production, 2014
Driefontein	Sibanye Gold Ltd	551 559
West Wits	Anglogold Ashanti	545 000
Kloof	Sibanye Gold Ltd	529 882
Vaal River	Anglogold Ashanti	452 000
Beatrix	Sibanye Gold Ltd	322 000

Source: UNCTAD secretariat based on the annual reports of the gold mining companies.

Note: All-in sustaining costs (2014): $1,104 per troy ounce (average computed by UNCTAD from appendix 2 of this report).

[25] Compared with less than $900 per ounce in Australia, Canada, the Russian Federation and the United States, for instance (see appendix 2).

vi. Peru

Peru ranks sixth among the leading gold-producing countries, tying with South Africa in 2014. However, the two countries' historical backgrounds in terms of gold production are different.

The development of the gold sector in the country has been strong since the beginning of the 1980s, when less than 4 tons of gold extracted. Following a decline between 2005 and 2014, gold production reached 150 tons in 2014, which was 5 per cent of world production.

Peru is the leading gold-producing country in Latin America, and despite the recent contraction of its gold production from its peak of 208 tons in 2005 (i.e. 8.3 per cent of world gold production), export revenues received from gold continue to be a major contributor to the country's economy. Gold was the most important commodity exported by Peru in 2012 and 2013, accounting for 21 per cent and 14 per cent of total Peruvian merchandise export revenues, respectively.

Apart from large mining facilities, mostly located in the Cajamarca, La Libertad and Piura regions in the north-west of the country, small-scale and artisanal mining, often illegal (box 2), largely contributed to Peruvian gold exports up to 2014 (about one fifth, according to sources). According to UNEP (2012) about 81,000 illegal miners extract gold in Peru, mostly in the Madre de Dios region, representing an annual production of 28 tons (about 30 per cent of Peruvian production since 1980). UNEP also alleges that small-scale gold mining in Peru may have led to the destruction of large areas of the Amazon forest (more than 32,000 hectares) and the poisoning of surrounding water sources, largely due to the release of mercury into the environment – 30–40 tons per year, according to government estimates (see box 1 concerning the use of mercury and its harmful effects). Given these damaging impacts on the environment and local populations, in April 2014 the Peruvian authorities decided to ban illegal mining in the country.

Table 9. Five leading gold-producing mines in Peru, 2014 (troy ounces)

Mine	Operator	Production, 2014
Yanacocha	Newmont Mining Corp (51.35%), Compañia de Minas Buenaventura, (43.65%), International Finance Corporation (5%)	970 000
Lagunas Norte	Barrick Gold Corp	582 000
Cerro Corona	Gold Fields Ltd	327 000
Orcopampa	Compañia de Minas Buenaventura	203 226
La Zanja	Compañia de Minas Buenaventura	76 180

Source: UNCTAD secretariat, based on the annual reports of the gold mining companies.
Note: All-in sustaining costs (2014): Not available.

viii. Other gold-producing countries

Gold is of vital importance to many countries in Africa, Latin America and Oceania, even though their share in global gold exports is far smaller than that of any of the countries discussed above. In 2012–2013, for instance, gold accounted for an overwhelming share of the merchandise export revenues of Burkina Faso, Guyana, Mali, Papua New Guinea, Suriname and the United Republic of Tanzania (table 10). For these countries, therefore, large fluctuations in the price of gold can have dramatic effects on their economies and their development, particularly because of the lack of diversification of their economies and their lower capacity to rapidly switch to other types of commodities when gold prices fall sharply (and vice versa).[26]

As mentioned in the introduction, world gold supply can come from mining operations or from the recycling of above-ground gold stocks. Recycling represents a faster and easier way for gold supply to adjust to world gold demand or prices in comparison to mine production, especially when it relates to short-term movements. Indeed, for individuals, the sale of gold is a rapid and easy way to access cash. Moreover, mining capacity is more difficult to adapt quickly, given the period of time necessary for the development of a mine. In the long run, quantities of gold supplied through gold recycling tend to increase. Gold recycling accounted for about a third of total gold supply between 1995 and 2014, with about 90 per cent extracted from high-value gold (e.g. jewellery) and 10 per cent from industrial gold (Boston Consulting Group and World Gold Council, 2015).

International gold prices and economic conditions are the main drivers of gold recycling and its share in world gold supply. Statistics related to gold recycling show that the rise in international gold prices and adverse economic conditions tend to lead to an upward trend in gold recycling (figure 16).

[26] Leyland J (2005). A touch of gold: Gold mining's importance to lower-income countries. London, World Gold Council. Available at: http://www.gold.org/research/touch-gold.

Table 10. Economic importance of gold in selected countries

	Production (tons)	Share of gold in total merchandise export revenues (per cent)		Ranking of gold in commodity exports (in value terms)	
	2013	1995–1996	2012–2013	1995–1996	2012–2013
Argentina	52.5	-	2.3	-	6
Brazil	79.6	1.0	1.1	12	13
Burkina Faso	32.6	10.0	45.0	2	1
Chile	51.3	2.6	1.9	7	7
Colombia	55.7	1.8	4.8	9	4
Ghana	90.5	8.6	11.2	5	3
Guyana	15.0	24.0	45.0	1	1
Indonesia	59.1	0.1	1.0	33	11
Kazakhstan	43.5	-	0.8	81	12
Mali	41.8	12.0	44.0	1	1
Mexico	117.8	0.2	2.1	14	2
Papua New Guinea	56.0	9.0	25.0	5	1
Philippines	17.2	1.1	0.7	6	10
Sudan	24.8	n.a	31.0	n.a	2
Suriname	11.0	5	54.0	5	1
United Rep. of Tanzania	43.4	0.3	18.0	27	1
Uzbekistan	73.0	7.2	2.2	2	5

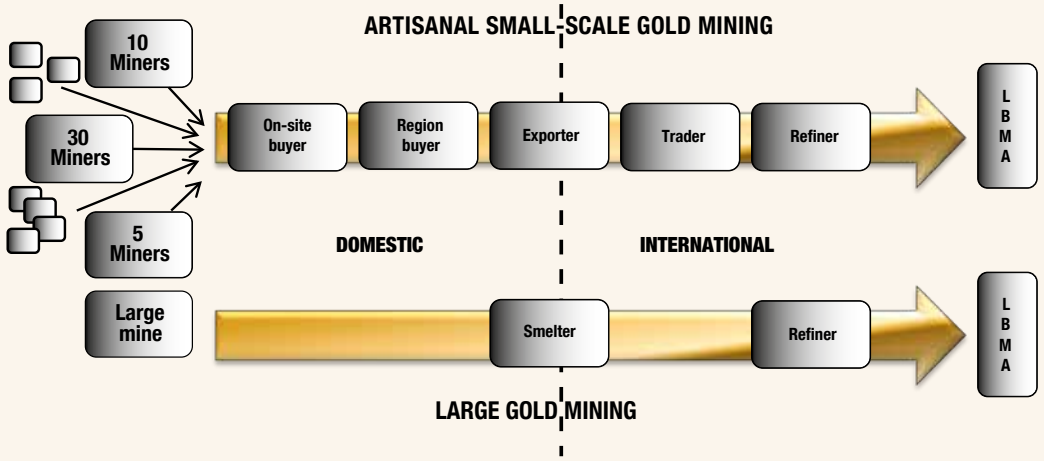
Source: UNCTAD secretariat, based on British Geological Survey, 2015 (for production statistics) and UNCTADstat (for trade statistics).

BOX 2. Artisanal and small-scale gold mining (ASGM)

ASGM activities occur in 70 countries worldwide, and contributed to more than 10 per cent of gold production in 2014. They are mainly concentrated in remote areas in sub-Saharan Africa, Latin America as well as East and South-East Asia. ASGM is more labour-intensive than capital-intensive, and provides direct employment to about 15 million people around the world (90 per cent of gold miners are considered to be artisanal and/or small-scale miners, according to the Artisanal Gold Council), while indirectly supporting the livelihoods of 100 million people. Among ASGM workers, about 20 per cent are estimated to be women and children (sometimes younger than 10 years of age).

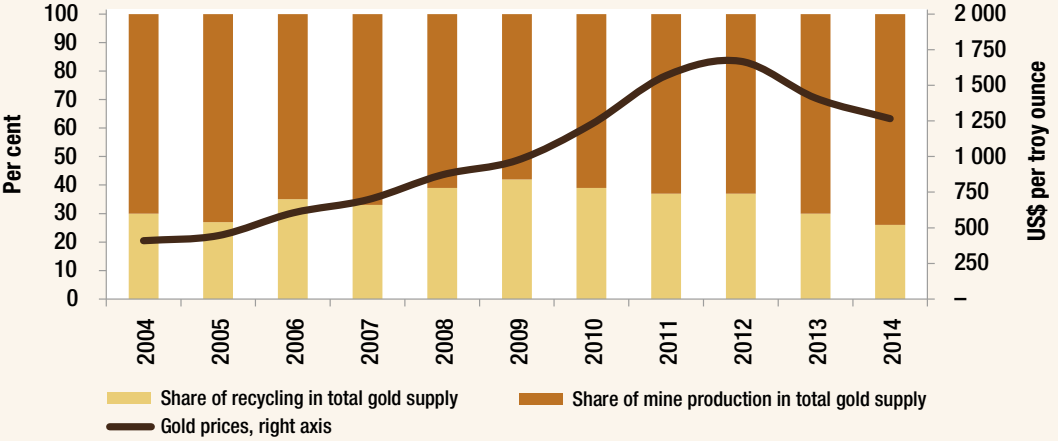
A large number of ASGM activities worldwide are conducted outside the law, which has huge impacts on the workers, the local environment and local communities. Due to their weak organizational structure, artisanal and small-scale miners have less (or no) access to financing and other support services, and their access to markets is more limited than that large-scale mining operations, with many more intermediaries (figure 15). As they are not governed by national or international regulations, ASGM activities generally have poor social and environmental standards, such as the use of child labour, gender imbalances, air, water and soil pollution through the release of hazardous chemical substances into the environment (e.g. mercury, cyanide), and the creation of smuggling networks leading to unlawful financing of illicit activities, including armed conflicts. This led to the development of a numbers of regulations and guidelines by the United Nations, regional country groupings, individual States and professional associations to ensure that the production of gold, in every sense, complies with humanitarian laws, respects human rights and does not contribute to the financing of armed conflicts. Some examples of these regulations or general guidelines are: *Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas* implemented by the OECD, *Section 1502 of the Dodd-Franck Act* in the United States of America, Responsible Gold Guidance of the London Bullion Market Association and the *Conflict-Free Gold Standard* developed within the framework of the World Gold Council. According to UNEP (2015a), at least 40 per cent of all internal conflicts over the past 60 years have been linked to the exploitation of natural resources.

Figure 15. Large-scale gold mining versus artisanal small-scale gold mining



Source: Richard et al, 2014.
Note: LBMA stands for London Bullion Market Association.

Figure 16. Distribution of world gold supply between mine production and recycling, as a percentage of world gold supply (per cent) compared to international gold prices (dollars per troy ounce), 2004–2014



Source: UNCTAD secretariat, based on UNCTADstat (for gold prices) and Thomson Reuters Eikon (for world mine production and world scrap supply).
Note: Data for 2014 are estimates.

According to the World Gold Council, price fluctuations accounted for around 75 per cent of the changes in recycling quantities between 1982 and 2012.[27] While the share of recycling in world gold supply was 17 per cent in 1999 with an average annual price of $279 per troy ounce, this percentage jumped to an average 39 per cent between 2008 and 2012 in line with the historical rise of international gold prices, which reached an average of $1,609 per troy ounce over the same period. With the slight improvement of economic conditions since 2012 and the consecutive decrease of international gold prices, the share of recycling in world supply tended to contract, finally reaching 26 per cent in 2014 – its lowest level since 2005. In 2012, the main sources of gold recycling was the United States, followed by Italy, China, India, the United Arab Emirates, Turkey, the United Kingdom, Mexico, Egypt and Indonesia, which together produced more than half of the world total.[28]

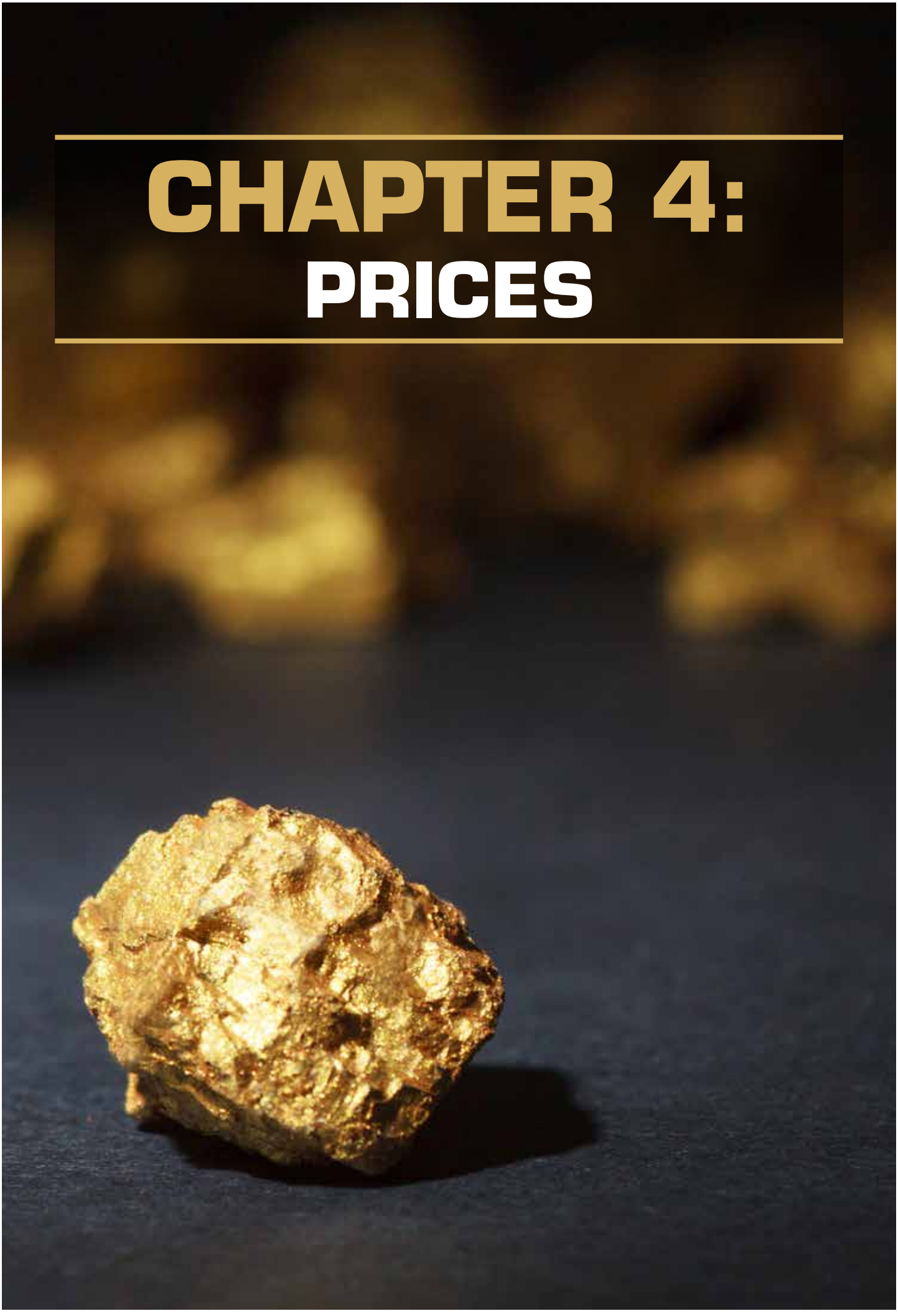
While the evolution of gold prices and global economic conditions generate a similar trend in the share of recycling in global gold supply, economic conditions appear to have longer term and stronger impacts on recycling. The impacts of the economic crises are felt by all economic actors across countries, and usually last for a longer period than price changes, which can be momentary.

The prospects for gold recycling appear to be optimistic in the long run, due to the large quantities available for recycling (above-ground stocks) worldwide compared to the ones in underground reserves (about a third), and the fact that gold recycling is more or less unlimited. Moreover, the consumption of technological devices using gold and with shorter life cycles (under 2 years) has been expanding worldwide, offering a growing reservoir for gold recycling. However, recycling gold from this source is highly challenging due to their current low rates of collection, the high-tech requirements of their recycling processes and their low gold content. For instance, it is estimated that a ton of mobile phones contains only 230 grams of recoverable gold (UNEP 2015b).

[27] World Gold Council, Gold recycling: New report examines the evolving industry that contributes a third of global gold supply, 5 March 2015; at: http://www.gold.org/news-and-events/press-releases/gold-recycling-new-report-examines-evolving-industry-contributes.

[28] PricewaterhouseCoopers LLP for the World Gold Council, The direct economic impact of gold, October 2013; at: http://www.pwc.com/en_GX/gx/mining/publications/assets/pwc-the-direct-economic-impact-of-gold.pdf.

CHAPTER 4:
PRICES



1. EVOLUTION OF GOLD PRICES

Since the beginning of gold price quotations on international markets in 1970, those prices have been driven mainly by market fundamentals (see chapters 2 and 3), particularly by changes in demand (e.g. for jewellery and industry applications). This has been the result of the large quantities of above-ground stocks of gold available compared to the average annual mine production, and its limited flexibility in meeting the demand. Exogenous factors, such as the world's geopolitical and economic environment, and dynamics in the financial sector, such as equity markets, also affect gold prices.

The benchmark price for gold, which is the "99.5% fine, afternoon fixing" quoted in dollars per troy ounce in London (figure 17), is the reference price used in this part of the report.

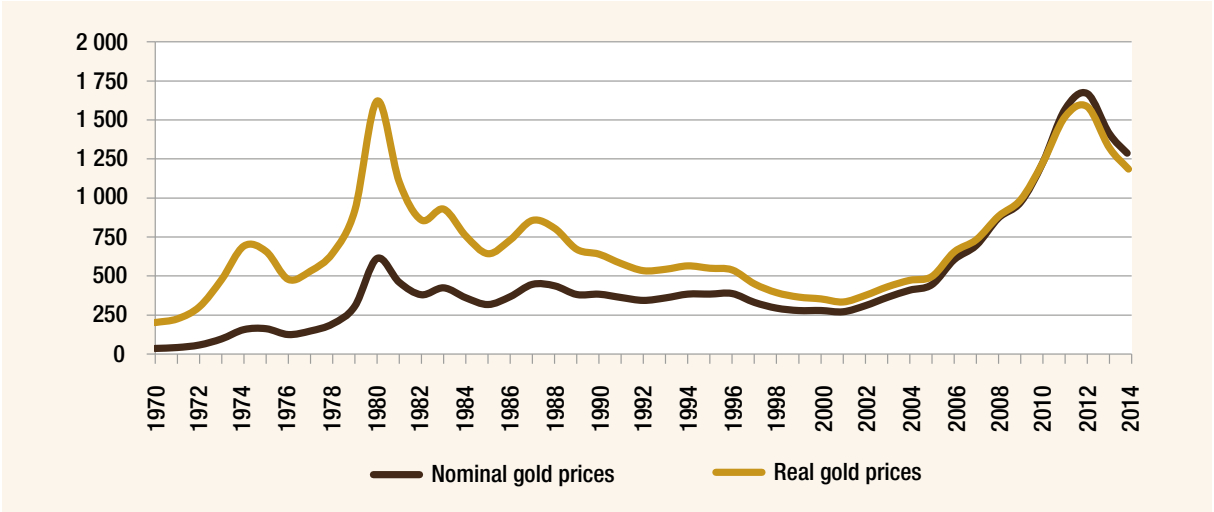
a. Evolution of gold prices during the 1970s

After decades of relative stability, gold prices entered a period of large price increases during the 1970s following the termination of the fixed peg of the dollar to gold. From $35 per troy ounce in 1970, as stipulated under the Bretton Woods Agreement, gold prices successively increased, to $162 in 1975 and $613 in 1980. Prices almost doubled between 1979 and 1980. Thereafter, they were mainly supported by the international economic context, and more specifically, by the recession resulting from the oil crises of 1973 and 1979 and by high inflation and unemployment rates. Between 1970 and 1980, the United States inflation rate averaged almost 8 per cent per annum. This period was also characterized by major geopolitical uncertainties, particularly the Iranian revolution, the end of the war in Viet Nam and the beginning of instability in Afghanistan, among others. In 1974, four decades after the decision banning American citizens from owning gold, United States President Gerald Ford overturned the ban. And in January 1976, the Jamaica Agreement was ratified, creating the free-floating exchange rate system.

b. Evolution of gold prices between 1980 and 2000

During the next two decades (1981–2000), gold prices followed a downward trend. This was mainly due to the end of the economic crisis of the 1970s and the progressive control of inflation. For instance, the United States annual consumer price index dropped to an average annual rate of 4.7 per cent over the 1980s and to 2.8 per cent in the 1990s. At the same time, gold mine production rapidly increased with an average growth of 3.9 per cent per annum between 1980 and 2000 (about 2.5 times its pace since the beginning of the twentieth century). This growth was mostly supported by large mining developments in Australia, Canada and the United States. Over the period, gold mine production more than doubled worldwide. These two decades were

Figure 17. Historical evolution of nominal and real gold prices, 1970–2014 (dollars per troy ounce, base year: 2010)



Source: UNCTAD secretariat based on UNCTADstat (nominal gold prices) and IMF, *International Financial Statistics* database (consumer price index, United States of America, accessed 8 June 2015).

Note: Real gold prices are based on United States inflation rate (i.e. consumer price index, all items, city average), IMF, International Financial Statistics database.

also characterized by a net selling position adopted by central banks, mainly in Europe. This is considered to have been a major factor affecting gold prices over this period, and it led to the first CBGA in 1999. The period ended when Switzerland became the last country to abandon the pegging of its currency to gold in 2000.

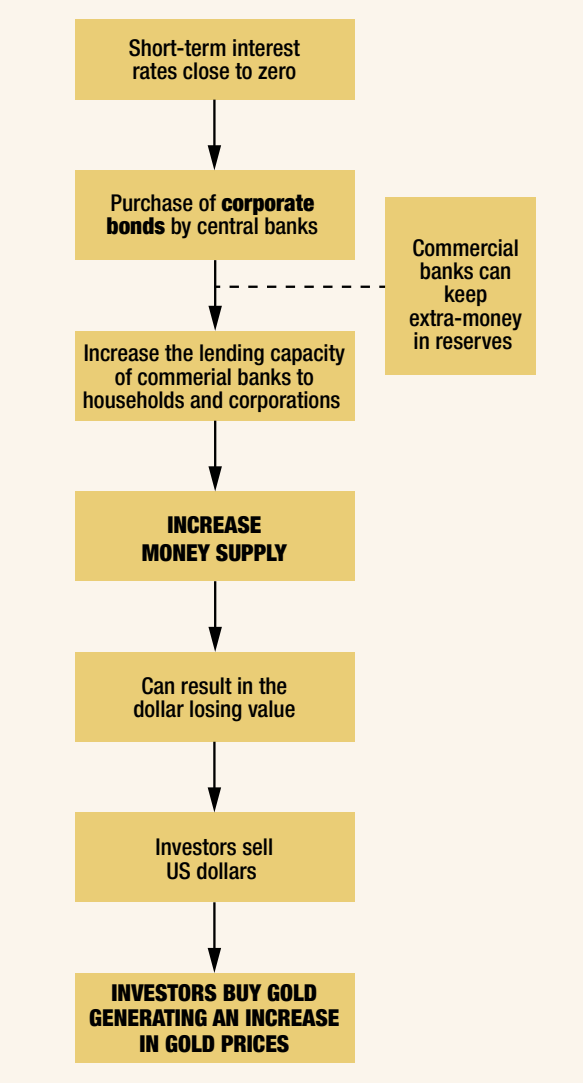
c. Evolution of gold prices since the beginning of the 2000s

From 2001 to 2012, gold prices recorded a historical price rise, gaining about six times their nominal value of 2001 (about 4.5 times in inflation-adjusted terms) to reach an average of $1,670 in 2012. This massive price rise was just 2 per cent lower than their record level of 1980 in real terms. The rise was supported by strong physical market conditions, with gold mine production contracting between 2000 and 2008 (by 11 per cent). This was mainly due to low gold prices during the previous period and the progressive deterioration of ore grades worldwide. In addition, due to the worsening global economic conditions since 2008, the share of gold acquired as a financial asset started to supplant the demand for jewellery and industrial applications. This had a positive impact on prices, which started to rise again. For example, demand associated with exchange traded funds (ETFs) jumped from 253 tons in 2007 to 623 tons two years later. At the same time, demand for bars and coins more than doubled between 2007 and 2008. While the change in ETFs was short-lived, growth in physical demand for bars and coins remained robust up to 2013, when this sector reached a record level of 1,772 tons – an increase of more than 300 per cent compared with 2007.

Since the beginning of the financial and economic crisis in 2008, the United States, followed by the United Kingdom, Japan and, more recently, the EU, initiated a number of quantitative easing programmes aimed at increasing money supply, as well as supporting domestic demand and spending by households and companies. This unorthodox monetary policy, with its potential inflationary and currency devaluation risks, contributed to attracting a new wave of investors into the gold market (figure 18) that considered gold to be a more attractive and secure asset when other financial investments took a dive. For instance, between the first quarter of 2008 and the second quarter of 2015, 10-year bonds lost 97 per cent of their yield in Germany, 54 per cent in the United States and about 75 per cent in Japan.[29]

[29] Thomson Reuters Eikon.

Figure 18. How quantitative easing affects gold prices



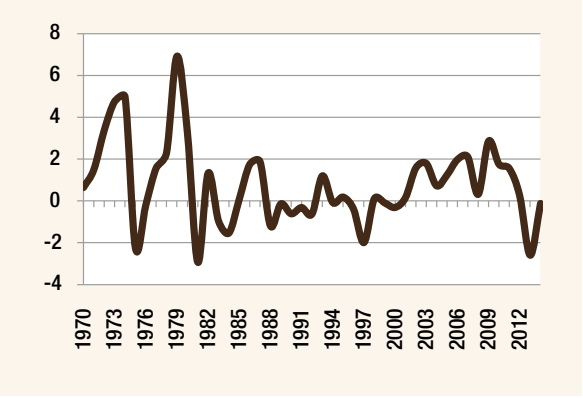
Source: UNCTAD secretariat.

Since 2010, central banks have become net buyers of gold after more than two decades as net sellers, mainly driven by large purchasing programmes initiated by emerging market economies' central banks, as well as a reluctance by European countries' central banks to sell their gold reserves (chapter 2). This too has influenced the general trend in gold prices.

The highs in gold prices up to the end of 2012 have been compared to the price boom of the 1970s. However, even though the pre-2012 nominal gold prices sharply exceeded the levels of the 1970s, in real terms they remained below their levels of the 1970s. Moreover, price volatility during the period 2002–2012 remained far lower than in the 1970s (figure 19a). For instance, while the average monthly change in gold

prices was 2.4 per cent between 1970 and 1980, this percentage dropped to 1.5 per cent between 2002 and 2012. Furthermore, extreme changes were more significant during the 1970s than the 2000s, with several monthly growth rates exceeding 15 per cent during the 1970s.

Figure 19a. Average monthly change in the price of gold, 1970-2014 (per cent)

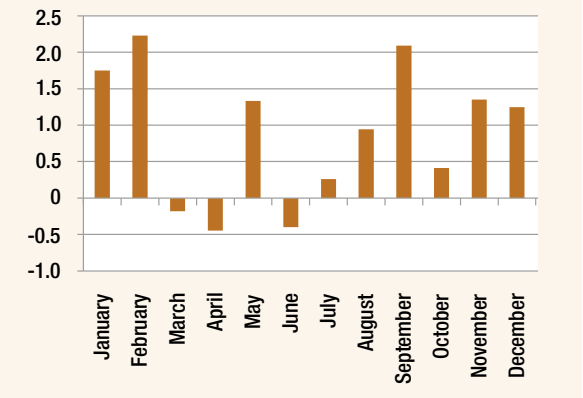


Source: UNCTAD secretariat, based on UNCTADstat.

Gold prices started to decline from October 2012. In August 2015, the value of gold had lost about 35 per cent of its October 2012 value, reaching its lowest price since April 2010. This decline is mainly attributed to economic recovery in the United States, which pushed investors to switch to dollar-denominated assets. Moreover, gold prices also largely suffered from an appreciation of the dollar compared to other major currencies and the euro.

Gold also displays marked seasonal behavior as can be seen from figure 19b. For an average year, gold prices peak during the seven months from August to February. This period starts with the beginning of a major festival in India in August, followed by the wedding season in the country (September to January), and then the New Year celebrations in China (January and February). These events are recurrent and generally explain the increase in gold prices during these periods.

Figure 19b. Seasonality of gold prices, 2000-2014 (monthly percentage change)



Source: UNCTAD secretariat, based on UNCTADstat.

2. GOLD PRICES AND IMPACTS ON PRODUCING COUNTRIES

The sharp rise in gold prices in dollars on international markets, has not necessarily translated into a similar growth in the prices received by producing countries, notably as a result of the depreciation of their national currencies against the dollar. Moreover, the rise of other commodity prices worldwide, particularly energy, led to a fourfold increase in production costs in the gold industry between 2002 and 2012. This also negatively affected revenues received by producing countries. For instance, while international gold prices increased by 275 per cent between 2005 and 2012, in Ghana, revenues from gold rose by only 90 per cent.

Apart from gold export earnings, producing countries also receive revenues from their gold sector through the collection of taxes and royalties. For instance, according to the World Gold Council (2011), "the [Peruvian gold] sector contributed an average 14% to government revenues between 2000 and 2010 (whereas its GDP contribution was 6%)". As a result of the recent increases in gold prices, some producing countries, especially in Africa, have decided to revise their national mining codes in order to benefit more from their extractive sector. The example of Burkina Faso is particularly interesting in this regard. In 2003, Burkina Faso instituted a minimum ad valorem royalty tax rate of 3 per cent on precious metals extraction. This rate is the most commonly applied throughout Africa. However, in Burkina Faso, this minimum rate has been pegged to gold prices, and increases following the rise in gold prices (table 11). Gajigo et al. (2012a) indicate that "royalties, as a share of production cost, are small in Africa… [and that] the level at which royalties, as a share of costs, begins to have a significant effect on mine profit is far above the prevailing average rate in Africa". Moreover, as noted by these authors, producing countries also receive revenues through their taxation of corporate incomes. In Africa, for instance, this tax averaged 32 per cent.

Table 11. Mineral tax on gold mine production in producing countries, as of January 2012

Country	Name of the mineral tax	Rate	Basis
Argentina	Provincial mining royalties	3%	Mine head value
Australia	State royalties	0%–2.5%	Volume of minerals extracted
Botswana	Mining royalty	5%	
Brazil	Compensation for the Exploitation of Mineral Resources (CFEM)	1%	Adjusted revenue
Burkina Faso	Mining royalty	Min. 3% 4% ($1 000–$1 300) 5% (> $1 300)	Effective rate varies positively with gold prices (ranges are indicated between parenthesis)
Cameroon	Mining royalty	2.5%	
Canada	Quebec mining tax	16%	Adjusted profit before tax (PBT)
Canada	British Columbia mining tax	2%-13%	Adjusted PBT
Canada	Ontario mining tax	5%-10%	Adjusted PBT
Central African Republic	Mining royalty	3%	
Chile	Specific mining tax	0%-14%	Adjusted PBT
China	Resource tax	RMB 1.5–RMB 7 per ton	Units produced (weight)
China	Compensation for mineral resource	0.5%–4.0%	Turnover
China	Royalty fee for exploration right and exploitation right	Years 1, 2 and 3: RMB 100 From year 4: + RMB 100 per year Ceiling of RMB 500	Mining area (per annum per km²)
Côte d'Ivoire	Mining royalty	3%	
Democratic Republic of the Congo	Mining royalty	2.5%	Adjusted revenue
Congo	Mining royalty	5%	Market value
Gabon	Mining royalty	3%–7%	As a function of the difficulty of the project
Ghana	Mining royalty	5%	Turnover
Guinea	Mining royalty	5%	
India	Mining royalty	2%	Units produced
India	Deadrent	INR 4,000/ha	Area of mine
Indonesia	Government royalty	3.75%	Turnover
Kazakhstan	Mining extraction tax	5%	Value of minerals
Liberia	Mining royalty	3% - 10%	
Mali	Mining royalty	3%	
Mauritania	Mining royalty	4%	
Morocco	Mining royalty	3%	
Namibia	Mining royalty	3%	
Niger	Mining royalty	5.5%	
Peru	Mining royalty	1%-12%	PBT
Peru	Special mining tax	2%–8.4%	PBT
Peru	Special mining contribution	4%–13.12%	PBT
Philippines	Excise tax	2%	Market value
Philippines	Royalties to mineral reservations	Min 5%	Market value
Philippines	Royalties to indigenous cultural communities	As agreed	Min. of 1% gross output
Russian Federation	Mining resources extraction tax	6%	Value or quantity of extracted mineral resources
Senegal	Mining royalty	3%	
Sierra Leone	Mining royalty	5%	
South Africa	Mining and Petroleum Resources Royalty (MPRD)	0.5% - 5%	Adjusted revenues
Ukraine	Charge for use of subsoil and pollution tax	UAH 15.98/ton extracted	Units produced
Uganda	Mining royalty	3%	
United Republic of Tanzania	Mining royalty	4%	Market value
United States of America	Federal Land Royalty	0%	Turnover
United States of America	Nevada Net Proceeds Tax	2%–5%	Adjusted PBT
United States of America	Other State severance taxes	2%–5%	Adjusted PBT
Zambia	Mining royalty	5%	

Source: UNCTAD secretariat based on PricewaterhouseCoopers, 2012, and Gajigo et al., 2012b.

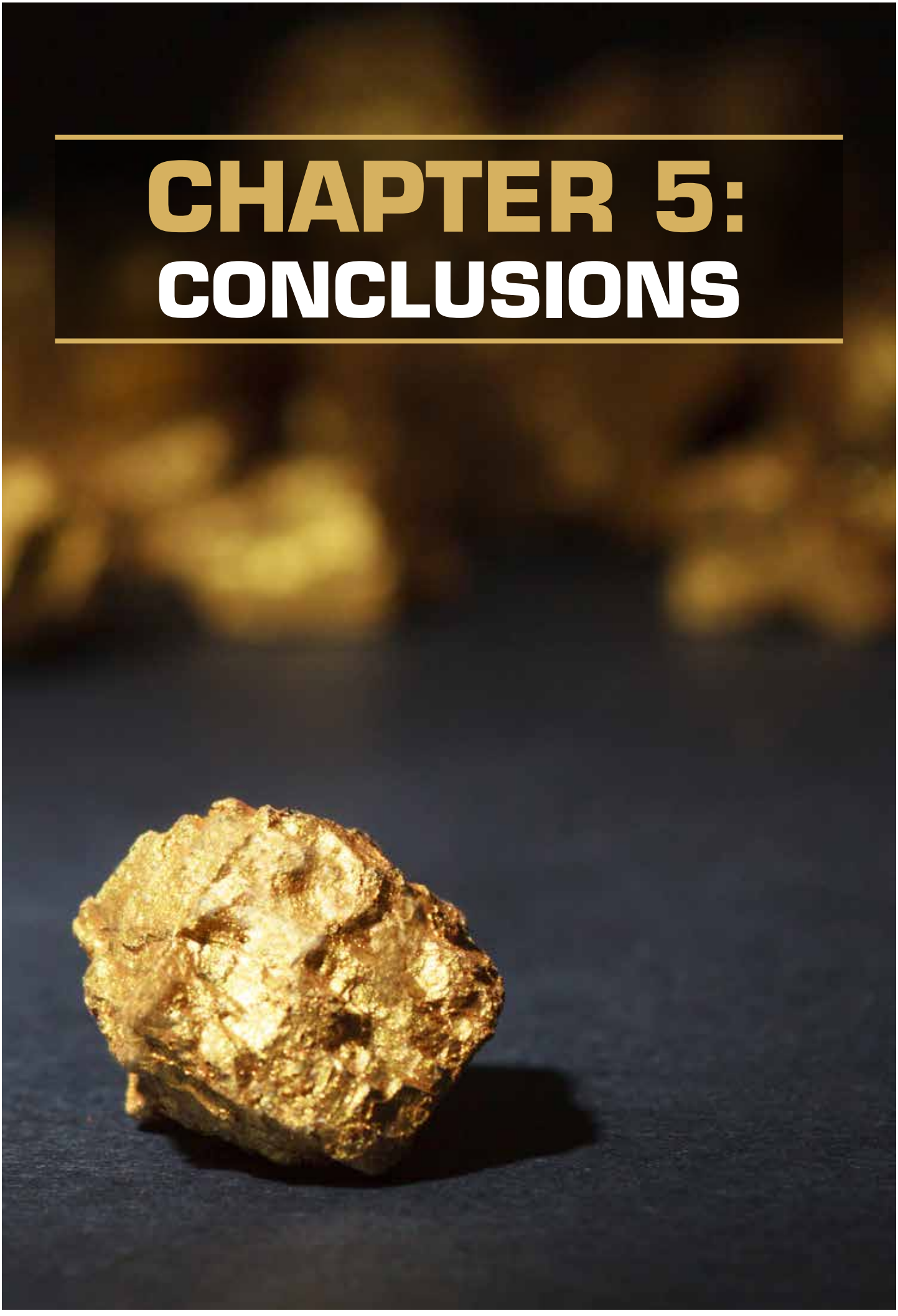
As taxes and royalties contribute to government revenues, they could also be used by producing countries as a tool to limit the environmental and social costs generated by gold mining operations. In Ghana, for example, surface mining is the root cause of the destruction of most of the rainforest (88 per cent), and such potentially irreversible damage can considerably reduce the biodiversity and have an adverse impact on food security (Akpalu and Parks, 2007). For instance, rural populations living in rainforest areas in Ghana derive three quarters of their consumption of proteins from bush meat, while this percentage reaches 80–90 per cent in Liberia, according to the Food and Agriculture Organization of the United Nations (FAO, undated). Moreover, rainforests are also a large source of drinking water. As a solution, Akpalu and Parks (2007) propose the introduction of a flexible ad valorem severance tax on gross revenues adjustable to the depletion of the rainforest stock. Indeed, Ghana is losing out if the environmental damage caused by gold mining is incorporated in the calculation of the net income derived from gold in the country. Internalizing these costs would imply a much higher tax on gold.

While gold prices are expected to remain low in the coming months, it is highly likely that population and demand growth as well as the general improvement in the standard of living, mainly in China and India, will contribute to supporting gold prices over the long term.

Just as the price boom of the 2000s resulted in the expansion of gold mining activities worldwide and led to the development of new operations with higher production costs, it is highly likely that the current downward trend in gold prices will lead to the closure of non-profitable producing facilities, which may also contribute to rebalancing supply and demand in the years to come and help support gold prices.

Gold demand has tended to increase with economic and financial uncertainties. As the economic situation is gradually improving in the United States and stabilizing in Europe, the situation in the gold market may improve in the foreseeable future.

CHAPTER 5:
CONCLUSIONS



Mining is a foundation industry and the gold industry is of particular importance for the economies of a large number of countries in Africa, Asia and Latin America. For Burkina Faso, Guyana, Mali and Suriname, for instance, gold exports fetched the largest revenues in 2012–2013, accounting for more than 40 per cent of their total merchandise export revenues. However, some exporting countries were not able to take advantage of the recent rise in gold prices to reduce their poverty and generate substantial resources to finance their development programmes. The following are among the major challenges facing gold-producing countries in this respect: (1) a lack of transparency and poor governance in the mining sector, (2) the potential short-term and long-term negative impacts of the gold industry on the environment and local populations, and (3) the volatility and unpredictability of gold revenues.

1. IMPROVING GOVERNANCE AND ENHANCING MARKET TRANSPARENCY

Poor governance, a lack of transparency, a weak regulatory framework and lack of monitoring are among the main challenges affecting the development of the gold sector in developing countries. These elements tend to be highly damaging in terms of lost government revenues, but also, and more importantly, in terms of political and social stability and development. Chapter 3 of this report noted that the prevalence of illegal gold production and smuggling can lead to the financing of armed conflicts leading to political and social unrest. Poor monitoring of the gold sector also tends to be associated with poor social practices, such as the use of child labour, widening inequalities between men and women, and numerous cases of breaches of human rights, among others. In order to deal with these issues:

- Governments should define long-term sound and predictable strategies and policies aimed at creating an enabling business environment and enhancing development linkages.
- Resource-rich countries, mining firms, consuming countries, civil society, and final consumers should pool their efforts to ensure that gold revenues contribute to the sustainable development of developing countries.
- All stakeholders should ensure that gold production adheres to the principles of respecting human rights, prohibiting child labour and promoting gender equality; it should not contribute to local instability. The Kimberley process[30] developed for preventing trade in "conflict diamonds" could be of interest in regions where gold production and trade have been observed to contribute to the financing of armed conflicts.

2. ENSURING THE USE OF ENVIRONMENT-FRIENDLY PRACTICES

While large-scale gold mining operations are making considerable efforts to eliminate the use of mercury and reduce the use of cyanide to minimum levels in gold extraction, such hazardous substances continue to be widely used in small-scale artisanal operations, where they have negative impacts on local populations and the environment:

- Governments, local authorities, mining companies and civil society should ensure that the extraction of gold does not damage the environment during the life cycles of the mining activities. This may entail the participation of local communities in the decision-making process.
- Governments should abolish the use of mercury in their countries, and ensure that the use of cyanide follows the best practices available.
- The international community should promote market transparency in the gold value chain, and, more particularly, disseminate information on how best to avoid the negative effects of mercury and cyanide on local populations and the environment, among others. This is particularly relevant for artisanal and small-scale mining.

3. SECURING HIGHER REVENUES FROM GOLD PRODUCTION

The volatility of international prices of gold is one of the major issues the sector has to deal with worldwide. Since the beginning of the 1970s, gold prices have experienced a series of booms and busts, resulting in unpredictable revenues received by gold-producing developing countries. This volatility affects planning for medium- and long-term development.

Devising solutions to this problem should take into account the current context of rising operating

[30] See: www.kimberleyprocess.com/en/faq

costs, contraction of gold reserves worldwide and a general degradation of gold ore grades. Moreover, it is essential for developing countries to put in place institutions that will help them to manage better the revenues they receive from gold, be they export earnings, mining taxes or royalties.

- Local authorities and investors should ensure that statistical information concerning revenues received from taxes and mining royalties is made public in order to foster transparency.
- Local authorities should put in place strong, reliable and effective institutions to deal with the monitoring of the gold value chain in their country and to manage, with due diligence, the revenues received from gold production and trade.

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APPENDIX 1:
THE METALLURGY OF GOLD

1. LEACHING

The first step in gold processing is known as leaching. Assuming that gold appears as an oxide, and depending on the gold content in host rocks, leaching can be achieved by: (i) heap leaching for low-grade ores, or (ii) tank leaching for high-grade ores. Both these processes rely on the use of sodium cyanide (NaCN) to extract gold. In fact, according to Elsner's equation,[31] cyanide and gold form a complex, which can ease the recovery of the latter.

Based on its cost advantage and its efficiency, and despite its potential damaging impacts on local populations and the environment, the cyanidation process developed at the end of the nineteenth century is still the main process used in the world for gold extraction (about 90 per cent of all gold extracted).[32] Usually, between 300 mg/l and 500 mg/l of cyanide are necessary to extract gold efficiently depending on the type of ore treated, but this quantity may reach 2,000 mg/l in some cases.

a. Heap leaching

Heap leaching, which was introduced in 1969, involves spraying a dilute alkaline solution of sodium cyanide (pH 10–11) uniformly on the top of a heap of gold ore. The homogeneity of the heap and its permeability are key success criteria for gold extraction. Strict control of the pH level of the cyanide solution is also extremely important: below pH 10, the consumption of cyanide will increase and above pH 11, gold recovery will decrease. During the operation, the solution percolates through the ore to the bottom of the heap, where the pregnant solution containing gold is collected through a drainage system and further processed. The resulting barren solution with cyanide added to it is reinjected onto the heap or sent to tailing storage facilities. The potential danger posed by this type of leaching process requires the careful configuration of leaching facilities (e.g. analysis of local meteorological conditions, probability of heavy rainfall and the use of impervious geomembranes).

Heap leaching is time-consuming (from a few weeks to several months) and recovery rates are low (generally between 40 per cent and 85 per cent).[33] However, this method can be used to treat lower grade gold ores, as it offers a less costly solution than tank leaching, thus greatly contributing to the development of mines worldwide where low grade geological resources are found. Moreover, as heap leaching can be undertaken on run-of-mine ores or on more coarsely crushed ores, the grinding phase is less costly than for tank leaching.

b. Tank leaching

Gold ore is ground into a fine powder (also known as pulp or slurry) to increase the exposure of gold particles and facilitate their recovery. Oversized pieces may be removed by screening and ground again. Gold ores can also be concentrated by gravity in order to recover native gold before processing. If gold ores are not permeable enough (e.g. having a high clay content), lime may be added to ease the operation. The agglomeration with lime will also ensure that the alkalinity of the solution remains between pH 10 and 11[34] to prevent the formation of hydrogen cyanide gas (HCN), which is poisonous, extremely flammable, and can become explosive when in contact with air.[35] The slurry is then loaded into a series of leaching agitated tanks and flooded with a cyanide solution. Oxygen is also injected to improve the environmental conditions for gold recovery.

Tank leaching entails high capital and operating costs. This is why it is only used to process ores with high gold content (more than 20 grams of gold per ton). However, it is also a fast processing method (24-48 hours on average) and offers high recovery rates (about 90 per cent).

OUTPUT: CYANIDE LEACHATE

2. GOLD RECOVERY

Gold may be recovered from cyanide leachate using the Merrill Crowe (MC) process or one of the gold adsorption techniques. Both processes can be used

[31] Elsner's equation: 4 Au + 8 CN- + 02 + 2H2O = 4 Au(CN)2- + 4OH (see: International Cyanide Management Code, at: http://www.cyanidecode.org/cyanide-facts/use-mining).

[32] Despite this general use by the gold sector, this industry only accounts for 6 per cent of the 1.1 million tons of the cyanide produced every year (International Cyanide Management Code (undated). Cyanide use in mining. Available at: http://www.cyanidecode.org/cyanide-facts/use-mining).

[33] Techniques de l'ingénieur, La métallurgie de l'or, 10 June 2006; available at: http://www.techniques-ingenieur.fr/base-documentaire/materiaux-th11/elaboration-et-recyclage-des-metaux-non-ferreux-42370210/metallurgie-de-l-or-m2401/.

[34] According to some sources, the alkalinity may range from pH 9.5 to pH 13.

[35] It is colourless, with a recognizable smell of bitter almonds that not all individuals are able to detect.

separately or successively with carbon adsorption used first, followed by the MC process.

a. Merrill Crowe process

Also known as zinc dust cementation or zinc dust precipitation, the MC process was first introduced at the end of the nineteenth century. It is particularly suitable for gold with a high silver content. It is one of the most common methods used for gold recovery from pregnant cyanide solution. It is based on the fact that gold and silver are more noble metals than zinc.

The MC process involves four steps: (i) As the presence of solids in the leachate is likely to reduce the efficiency of the process and could therefore have a negative impact on gold recovery, the cyanide solution is first clarified (filtered). This step is particularly important after heap leaching, as it generates more solids than any other leaching technique. Filtration is done using media filters by counter-current filtration circuits or counter-current decantation. Specific filters may sometimes be used (pre-coated with diatomaceous earth) depending on the particular turbidity of the solution. (ii) The dissolved oxygen contained in the pregnant solution is then removed using vacuum pumps. This phase is called vacuum deaeration (or deoxygenation). (iii) Zinc powder is then added to precipitate the gold content. Lead salts in small quantities may also be added to accelerate the process by activating zinc particles. However, lead addition should remain limited as too high a content (>20 ppm) could generate an increase of zinc consumption. (iv) Gold precipitate and other particles are filtered out of the solution and sent for electrowinning.

OUTPUT: GOLD PULP

b. Adsorption on activated carbon

Carbon-in-column (CIC)

After the heap leaching step, the cyanide leachate is processed preferably using carbon-in-column (CIC) technology (also called “expanded carbon bed”). This method offers the possibility to treat solutions with high solid contents, which is often the case when gold is primarily heap-leached, as ores are coarsely ground or not crushed at all.

The pregnant solution circulates through a series of tall columns fuelled with activated carbon (most frequently made from coconut shells) and the gold is adsorbed onto the surface of the carbon. The solution flows upwards to the following column which is generally located lower than the previous one. The organization of the CIC in this kind of step fashion contributes to a reduction of the costs of production by eliminating the need to resort to a pumping system. The loaded carbon is periodically removed from the columns and stripped.

Carbon-in-pulp (CIP)

When activated carbon granulates are added as a separate step after the leaching, the process is known as carbon-in-pulp (CIP). Here, the pulp flows through a series of agitated vessels (generally 6) with activated carbon introduced at the tail end and the pulp containing gold loaded at the other end. Both the activated carbon and the slurry flow counter-current, and relying on the natural affinity between gold and carbon, gold is gradually adsorbed onto the carbon. The loaded carbon is filtered between each tank using coarse screens.

Carbon-in-leach (CIL)

When granular activated carbon is added in agitated tanks during the leaching phase, the dissolved gold contained in the solution gets directly adsorbed onto the carbon particles. The CIL process is mostly used when native carbon is already present in the ore. The adjunction of more active carbon in the tank (than the one already present naturally) will encourage the gold to preferentially load onto the new added carbon particles.

OUTPUT: GOLD-LOADED CARBON

3. ELUTION (STRIPPING OR DESORPTION)

The elution (also known as stripping or desorption) process aims to reverse gold adsorption onto activated carbon. Several techniques exist, two of the most commonly used being Zadra stripping and Anglo American Research Laboratories (AARL) stripping.

a. Zadra stripping

Developed in the early 1950s, the Zadra elution process is based on the principle of the flooding of activated carbon at atmospheric pressure with a water-based solution containing 1 per cent sodium hydroxide (NaOH) and 0.1 per cent to 0.3 per cent sodium cyanide (NaCN) at a temperature of 200°F (93°C).

Zadra is probably the easiest and the least expensive process to implement, but also gives the lowest yields

and is the most time-consuming, as the operation may take two to three days. The process can be accelerated using higher temperatures of about 275°F (135°C) in pressure stripping columns (400kPa to 500kPa). Accordingly, the "pressure Zadra process" can be reduced to half a day.

After elution, the barren solution can be recycled and reused.

b. Anglo American Research Laboratories (AARL) stripping

AARL technology has been used by the gold industry since 1980. In this process, the loaded activated carbon is treated in pressure stripping columns, where it is successively wetted with a solution of 1 per cent of sodium hydroxide (NaOH) and 3 per cent of sodium cyanide (NaCN). It is then eluted through successive baths of deionized water and heated at a temperature of about 240°F (115°C) under a pressure of between 70kPa and 100kPa. This process takes to 8–14 hours, on average.

OUTPUT: PREGNANT ELUATE, CONCENTRATED LIQUOR

4. ELECTROWINNING AND SMELTING

The liquor resulting from the Merrill Crowe process or the carbon adsorption processes is passed through a series of electrowinning cells. Electrowinning entails passing an electric current from a set of stainless steel anodes (positively charged electrodes) to a set of cathodes (negatively charged electrodes) through a liquor (the electrolyte).

The gold plated on the cathodes is collected for smelting in furnaces at high temperatures (> 1,200°C - 2,192°F) to stimulate the separation between the gold and the slag[36] (e.g. silver, copper, zinc or iron). Fluxing elements may be added to the blending (e.g. borax, niter and silica) to facilitate the removal of impurities in the slag. After smelting, the molten material is poured into a series of moulds for the production of Doré bars, also called bullions.

The weight and gold content of Doré bars may vary considerably from one facility to another; however they generally contain between 65 per cent and 95 per cent of gold. Although they can be sold as such, Doré bars are generally further purified to reach a purity level of 99.95–99.99 per cent, depending on their final potential uses.

OUTPUT: DORÉ BULLION OF PRECIOUS METALS

5. REFINING, FINAL PURIFICATION

a. Miller process

Doré bullions are heated in furnaces at temperatures higher than the melting point of gold (1,064°C). Some gaseous chlorine is blown onto the molten gold, which leads all elements present in the crucible, except gold, to form chlorides and rise to the surface of the container where they can be skimmed off. The molten gold is finally cast.

The Miller process produces gold of 99.5 per cent purity. It is a somewhat easy and rapid process (taking one and a half hours), and it is generally preferred to the Wohlwill process as it is comparatively cheaper. However, refining gold through the Wohlwill process can be necessary when very pure gold is required. In this case, the Miller process may be combined with the Wohlwill process to produce ingots of 99.99 per cent pure gold.

b. Wohlwill process

The Wohlwill process is the final step in gold processing and refining. It is a technique of purification of gold by electrolysis. Developed in the late nineteenth century, this method is preferred when metals from the platinum group are present, or when maximum gold purity is required.

The anodes are cast with "impure gold" of 95 per cent gold purity as a minimum. A lower purity reduces the efficiency of the process. Under the action of an electric current passing from the anodes to the cathodes plated with pure gold (24k gold sheets), through an electrolytic solution of pure chloroauric acid (HAuCl4), impurities sink to the bottom of the tank, while pure gold deposits settle onto the cathodes. Once anodes are entirely dissolved, gold cathodes are removed from the cells, melted and cast into ingots. The whole operation may take up to two days.

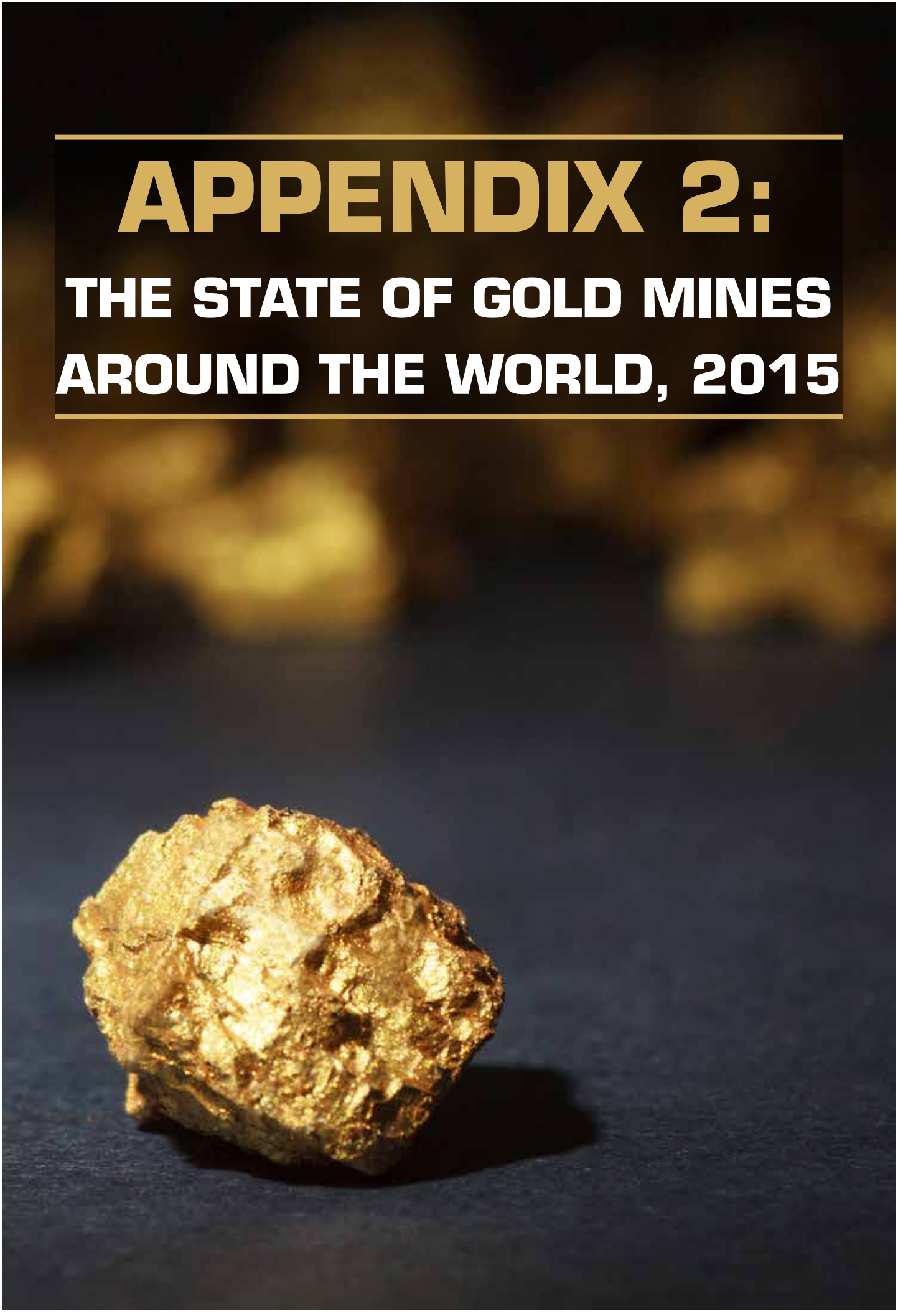
The Wohlwill process is more time-consuming than the Miller process, and more costly, mainly due to the high level of gold contained in the anodes, cathodes and electrolyte, which is needed for the operation.

OUTPUT: GOLD INGOTS READY TO BE SOLD ON MARKETS

[36] Defined by Oxford Dictionaries.as «Stony waste matter separated from metals during the smelting or refining of ore».

APPENDIX 2:

THE STATE OF GOLD MINES AROUND THE WORLD, 2015



Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 ($/oz)	Comments
BARRICK GOLD CORP.								
Argentina	Veladero	100	641 000	1.00	722 000	4 737 000	815	
Australia	Cowal	100	297 000		268 000	1 555 000	787	
Australia	Super Pit	50	315 000	2.01	326 000	3 482 000	1 037	Mine operated by Kalgoorlie Consolidated Gold Mines PTY Ltd – a 50/50 joint venture between Barrick Gold and Newmont mining
Canada	Hemlo	100	204 000	n.a	206 000	820 000	1 059	
Dominican Republic	Pueblo Viejo	60	488 000	5.53	665 000	9 318 000	588	Goldcorp (ownership: 40 per cent)
Papua New Guinea	Porgera	95	482 000	3.10	493 000	3 008 000	996	Government of Papua New Guinea (ownership: 5 per cent)
Peru	Lagunas Norte	100	606 000	0.99	582 000	2 833 000	543	
Peru	Pierina	100	97 000	n.a	17 000	n.a.	2 277	Closure decided as of August 2013
United States	Golden Sunlight	100	92 000	n.a	86 000	127 000	1 181	
United States	Bald Mountain	100	94 000	n.a	161 000	1 361 000	1 070	
United States	Cortez	100	1 340 000	1.34	902 000	9 851 000	706	
United States	Goldstrike	100	892 000	6.28	902 000	9 614 000	854	
United States	Round Mountain	50	156 000	n.a	164 000	690 000	1 170	Kinross Gold Corp. (ownership: 50 per cent)
United States	Ruby Hill	100	91 000	n.a	33 000	24 000	713	
United States	Turquoise Ridge	75	167 000	19.62	195 000	4 458 000	628	Newmont mining Corp (ownership: 25 per cent)
NEWMONT MINING CORP.								
Australia	Boddington	100	177 000	n.a	696 000	12 170 000	972	
Australia	Tanami	100	60 000	n.a	345 000	3 310 000	1 038	
Australia	Jundee	100	76 000	n.a	138 000	2 080 000	771	
Australia	Super Pit	50	78 000	n.a	329 000	3 480 000	1 009	Mine operated by Kalgoorlie Consolidated Gold Mines PTY Ltd – a 50/50 joint venture between Barrick Gold and Newmont mining
Ghana	Ahafo	100	125 000	n.a	442 000	9 910 000	849	
Ghana	Akyem	100	-	n.a	472 000	6 670 000	423	
Indonesia	Batu Hijau	48.5	14 000	n.a	76 000	3 340 000	1 458	Sumitomo Corporation and Newmont operate the mine. It is owned by PT Newmont Nusa Tenggara (PTNNT), a joint venture company between Nusa Tenggara Partnership B.V, PT Multi Daerah Bersaing (PTMDB), PT Pukuafu Indah and PT Indonesia Masbaga Investama
Mexico	La Herradura	44	55 000	n.a	124 000	-	1 601	Sold to Fresnillo plc on 7 October 2014
New Zealand	Waihi	100	30 000	n.a	132 000	360 000	687	

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
Peru	Yanacocha	51.35	285 000	n.a	498 000	2 490 000	943	Compañia de Minas Buenaventura, S.A.A.(ownership: 43.65 per cent) and International Finance Corporation (ownership: 5 per cent)
United States	Carlin complex	100	231 000	n.a	907 000	16 960 000	1 072	
United States	Phoenix	100	51 000	n.a	211 000	5 620 000	911	
United States	Twin creeks	100	99 000	n.a	389 000	2 150 000	820	
United States	Turquoise Ridge	25		n.a				Barrick Gold Corp (ownership: 75 per cent)
ANGLOGOLD ASHANTI LTD								
Argentina	Cerro Vanguar-dia	92.5	241 000	6.08	246 000	1 570 000	938	Fomicruz (ownership: 7.5 per cent)
Australia	Sunrise Dam	100	276 000	2.13	262 000	1 180 000	1 214	
Australia	Tropicana	70	66 000	2.78	358 000	2 630 000	752	Independence Group NL (ownership: 30 per cent). Operations began in 2013.
Brazil	AGA Mineração	100	391 000	5.65	403 000	1 970 000	966	2 operational units: the Cuiabá and the Córrego de Sítio
Brazil	Serra Grande	100	138 000	3.28	136 000	560 000	1 062	3 mechanized underground mines: Mina III, Mina Nova and Palmei-ras and an open-pit mine at Mina III.
Democratic Republic of the Congo	Kibali	45	40 000	2.95	237 000	5 170 000	588	Randgold (ownership: 45 per cent) and Société Minière de Kilo-Moto–SOKIMO (ownership: 10 per cent). Started commercial produc-tion in October 2013
Guinea	Siguiri	85	268 000	0.89	290 000	1 840 000	917	Government of Guinea (ownership: 15 per cent)
Ghana	Iduapriem	100	221 000	1.13	177 000	1 970 000	1 020	
Ghana	Obuasi	100	239 000	4.67	243 000	8 140 000	1 374	
Government of Ghana holds a 1.58 per cent direct stake in AngloGold								
Mali	Morila	40	57 000	1.06	44 000	40 000	1 298	Randgold Resources (ownership: 40 per cent) and Government of Mali (ownership: 20 per cent). Halted mining activities in 2009. Production is from the processing of remaining stockpiles
Mali	Sadiola	41	86 000	1.28	85 000		1 133	IAM Gold (ownership: 41 per cent) and Government of Mali (owner-ship: 18 per cent)
Mali	Yatela	40	27 000	0.59	11 000		1 795	IAM Gold (ownership: 40 per cent) and Government of Mali (owner-ship: 20 per cent). Headings towards closure and processing of stockpiles

Country	Mine	Ownership (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
Namibia	Navachab	100	63 000	1.44	33 000	1 920 000	719	In February 2014, AngloGold Ashanti signed a binding agreement to sell Navachab to QKR Corp.
South Africa	Vaal River mines	100	473 000	5.55 - 11.04	452 000	8 050 000	1 115	Vaal River mines (Great Noligwa, Kopanang, Moab Khotsong). Great Noligwa (nearing end of life)
South Africa	West Wits	100	589 000	8.21 - 8.99	545 000	15 960 000	1 020	West Wits mines: Mponeng, TauTona. Mponeng is the world's deepest gold mine
South Africa	Surface operations	100	240 000	0.20	223 000	6 890 000	1 153	Extract gold by retreating dumps and tailings from Vaal River and West Wits operations
United Republic of Tanzania	Geita	100	459 000	2.86	477 000	3 900 000	890	
United States	Cripple creek & Victor	100	231 000	0.32	211 000	4 710 000	1 147	An expansion project is in implementation phase and is expected to sharply increase production from 2015
KINROSS GOLD CORP.								
Brazil	Paracatu	100	500 380	0.41	521 026	10 510 000	973	
Chile	La Coipa	100	162 405	n.a	n.a	n.a	973	
Chile	Maricunga	100	187 815	0.74	247 216	1 670 000	973	No operation in 2014
Ghana	Chirano	90	247 862	3.08	257 888	924 000	973	
Mauritania	Tasiast	100	247 818	2.16	260 485	9 196 000	973	
Russian Federation	Kupol and Dvoinoye	100	550 188	13.51	751 101	2 089 000	973	Commercial production started in Dvoinoye in October 2013. Expected production: 235 000–300 000oz. Reserves in Dvoinoye are estimated at around 1 028 000oz
United States	Fort Knox	100	421 641	0.66	379 453	2 398 000	973	
United States	Round Mountain	50	162 826	0.94	169 839	689 000	973	Barrick Gold Corporation (ownership: 50 per cent)
United States	Kettle River - Buckhorn	100	150 157	9.98	123 382	101 000	973	

The "All-in sustaining cash cost" equals $973/oz sold in 2014 for Kinross Gold Corp.

Country	Mine	Owner-ship per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
GOLDCORP INC.								
Argentina	Alumbrera	38	117 500	0.39	120 100	760 000	609	Xstrata (ownership: 50 per cent) operates the mine, Yamana Gold (ownership: 12.5 per cent)
Argentina	Cerro Negro	100	n.a	n.a	152 100	5 260 000	n.a	Commercial production achieved on 1 January 2015. High-grade deposit
Canada	Musselwhite	100	256 300	7.38	278 300	1 660 000	811	Expected life of mine until 2026
Canada	Porcupine	100	291 900	2.45	300 000	2 980 000	908	Expected life of mine until 2026
Canada	Red Lake	100	493 000	19.47	414 400	2 060 000	934	Goldcorp top producing mine. Expected life of mine until 2025
Dominican Republic	Pueblo Viejo	40	324 000	n.a	439 100	6 210 000	n.a	Barrick Gold Corporation (ownership: 60 per cent)
Guatemala	Marlin	100	202 200	3.11	186 500	310 000	862	Exploration activities indicate potential for extension of mining activi-ties. Expected life of mine until 2018
Mexico	El Sauzal	100	80 600	1.40	No production	150 000	628	Closure scheduled in 2015
Mexico	Los Filos	100	332 400	0.67	258 700	6 770 000	993	Expected life of mine until 2027
Mexico	Peñasquito	100	403 800	0.65	567 800	10 550 000	813	Expected life of mine until 2026
United States	Wharf	100	56 200	0.02	62 500	560 000	1 165	Expected life of mine until 2020
NEWCREST MINING LTD								
Australia	Cadia Valley	100	446 879	0.52	592 831	28 000 000	326	
Australia	Telfer	100	525 500	0.91	536 342	6 300 000	1 005	
Indonesia	Gosowong	75	312 711	12.00	344 747	1 200 000	823	PT Aneka Tambang (ownership: 25 per cent)
Papua New Guinea	Lihir	100	649 340	2.40	721 624	29 000 000	1 261	
Papua New Guinea	Hidden Valley	50	85 004	1.60	105 845	1 700 000	1 402	Part of Morobe Mining Joint Venture. Ownership: 50 per cent with Harmony Gold Mining Company Limited
Côte d'Ivoire	Bonikro	89.9	90 350	1.30	94 994	1 500 000	1 193	Government of Côte d'Ivoire (ownership: 10 per cent) and a minority shareholder (ownership: 0.11 per cent)

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
GOLD FIELDS LTD								
Australia	Agnew/Lawlers	100	215 600	7.44	271 000	870 000	990	Expected life of mine until 2017
Australia	Darlot	100	19 700	7.36	84 000	90 000	1 222	Expected life of mine until 2015
Australia	Granny Smith	100	62 200	6.02	315 000	870 000	809	Expected life of mine until 2020
Australia	St Ives	100	402 700	3.14	362 000	1 800 000	1 164	Expected life of mine until 2019
Ghana	Damang	90	153 100	1.49	178 000	1 230 000	1 175	Expected life of mine until 2019. Government of Ghana (ownership: 10 per cent)
Ghana	Tarkwa	90	632 200	1.05	558 000	7 490 000	1 068	Expected life of mine until 2030. Government of Ghana (ownership: 10 per cent)
Peru	Cerro Corona	99.5	313 000	0.90	327 000	1 760 000	316	Expected life of mine until 2023
South Africa	South Deep	91.9	302 000	5.30	201 000	34 900 000	1 732	Expected life of mine until 2087. 10% to shareholders as part of BBBEE(b) transaction concluded in Dec. 2010
POLYUS GOLD INT. LTD								
Russian Federation	Alluvial deposits (Bodaybo district)	(38.4 - 62.9)	205 000	0.64	190 000	61 100 000	952	Expected life of mine until 2020
Russian Federation	Blagodatnoye	95.1	395 000	2.25	394 000	8 700 000	561	Expected life of mine until 2036
Russian Federation	Kuranakh	95.1	138 000	1.39	137 000	2 600 000	992	Expected life of mine until 2033
Russian Federation	Olimpiada	95.1	691 000	3.29	726 000	29 300 000	854	Expected life of mine until 2054
Russian Federation	Titimukhta	95.1	131 000	3.45	93 000	1 500 000	1 183	Expected life of mine until 2030
Russian Federation	Verninskoye and Smezhny	95.1	89 000	2.52	146 000	4 100 000	728	Expected life of mine until 2042
SIBANYE GOLD LTD								
South Africa	Beatrix	100	312 600	2.40	322 000	3 630 000	1 087	
South Africa	Driefontein	100	603 600	3.50	551 559	6 100 000	1 027	
South Africa	Kloof	100	513 700	3.80	529 882	6 020 000	1 014	
POLYMETAL INT. PLC								
Kazakhstan	Varvara	100	106 700	1.30	98 000	1 700 000	1 049	Expected life of mine until 2030
Russian Federation	Albazino	100	237 700	5.10	227 000	2 700 000	901	Expected life of mine until 2030
Russian Federation	Dukat Hub	100	40 600	7.70	45 000	3 500 000	11	Expected life of mine until 2024
Russian Federation	Khakanja	100	103 400	3.50	98 000	1 000 000	909	Expected life of mine until 2018

Country	Mine	Ownership (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
Russian Federation	Mayskoye	100	48 400	8.50	143 000	1 800 000	1 134	Expected life of mine until 2022
Russian Federation	Omolon Hub	100	115 200	4.40	176 000	1 300 000	722	Expected life of mine until 2021
Russian Federation	Voro	100	152 700	2.90	158 000	1 200 000	515	Expected life of mine until 2027
AGNICO EAGLE MINES LTD								
Canada	LaRonde	100	181 781	5.20	204 652	3 432 000	668	Expected life of mine until 2024
Canada	Lapa	100	100 730	5.84	92 622	170 000	667	Expected life of mine until 2016
Canada	Goldex	100	20 810	1.64	100 433	340 000	638	Expected life of mine until 2017
Canada	Meadowbank	100	430 613	3.08	452 877	1 168 000	599	Expected life of mine until 2017
Finland	Kittila	100	146 421	4.93	141 742	4 524 000	845	Expected life of mine until 2036
Mexico	Pinos Altos	100	215 800	3.01	171 019	1 763 000	533	Expected life of mine until 2025
Mexico	La India	100	3 180	0.85	75 093	679 000	487	Expected life of mine until 2020
RANDGOLD RESOURCES LTD								
Mali	Loulo-Gounkoto	80	580 364	4.60	639 219	4 900 000	672 (cash cost)	Government of Mali (ownership: 20 per cent). Reserves: 5.3 million oz for Loulo and 2.3 million oz for Gounkoto
Mali	Morila	40	141 822	0.70	110 272	300 000	1 143 (cash cost)	AngloGold Ashanti (ownership: 40 per cent), Government of Mali (ownership: 20 per cent)
Côte d'Ivoire	Tongon	89	233 591	2.30	227 103	2 200 000	872 (cash cost)	Government of Côte d'Ivoire (ownership: 10 per cent), local company (ownership: 1 per cent)
Democratic Republic of the Congo	Kibali	45	88 200	4.10	88 200	11 000 000	433 (cash cost)	AngloGold Ashanti (ownership: 45 per cent), SOKIMO (ownership: 10 per cent). Start of production in September 2013
YAMANA GOLD INC.								
Argentina	Gualcamayo	100	120 337	1.33	180 412	1 244 000	796 (cash cost)	
Argentina	Alumbrera	12.5	39 157	0.31	39 650	185 000	n.a	Xstrata (ownership: 50 per cent), Goldcorp (ownership: 37.5 per cent)
Brazil	Chapada	100	110 618	0.25	113 386	4 033 000	406 (cash cost)	

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
Brazil	Brio Gold	100	98 450	2.19	144 663	145 000	798 (cash cost)	Holds Fazenda Brasileiro, Pilar mines and C1 Santa Luz project
Brazil	Jacobina	100	73 695	2.82	75 650	2 074 000	1 078 (cash cost)	
Canada	Canadian Malartic	50	n.a	1.06	143 008	4 329 000	702 (cash cost)	Agnico Eagle Limitée (ownership: 50 per cent)
Chile	El Peñón	100	467 523	5.03	452 120	1 682 000	488 (cash cost)	
Chile	Minera Florida	100	118 590	3.70	119 582	516 000	617 (cash cost)	
Mexico	Mercedes	100	141 618	5.03	113 174	648 000	671 (cash cost)	
ALAMOS GOLD INC.								
Mexico	Mulatos	100	190 000	1.16	140 500	1 731 921	1 022	Expected life of mine until 2021
COMPANIA DE MINAS BUENAVENTURA S.A.A.								
Peru	Orcopampa	100	224 671	16.39	203 226	321 000	n.a	
Peru	Poracota	100	467	10.67	1 420	n.a	n.a	
Peru	Julcani	100	1 032	0.56	414	5 000	n.a	
Peru	Antapite	100	509	10.42	852	n.a	n.a	
Peru	Shila Paula	100	7 692	10.92	n.a	n.a	n.a	
Peru	Breapampa	100	81 882	1.31	74 807	19 000	n.a	
Peru	“Colquijirca & Marcapunta”	54	4 954	0.34	7 642	276 000	n.a	
Peru	La Zanja	53	72 902	0.72	76 180	244 000	n.a	
Peru	Tantahuatay	40	57 202	0.44	57 594	850 000	n.a	
Peru	Yanacocha	44	444 034	0.86	423 381	17 482 000	n.a	Newmont Mining Corp (ownership: 51.35 per cent) and International Finance Corporation (ownership: 5 per cent)

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
CENTERRA GOLD INC.								
Kyrgyzstan	Kumtor	100	600 402	2.80	423 381	6 136 000	779	Expected life of mine until 2023
Mongolia	Boroo	100	90 318	No more production in 2014			973	
CHINA GOLD INTERNATIONAL RESOURCES CORP.								
China	CSH	100	145 000	0.61	165 000	6 700 000	n.a	Expected life of mine until 2024
NAVOI MINING AND METALLURGICAL COMBINAT								
Uzbekistan. According to NMMC website, the company accounts for 80 per cent of gold production in Uzbekistan (e.g. Muruntau, one of the fifth largest world gold mines in the world, with 2 million ounces of gold produced annually)								
FREEPORT-MCMORAN INC.								
Indonesia	Grasberg	100	1 142 000	0.99	1 132 000	5 800 000	n.a	Grasberg open pit, deep ore zone and big gossan
ELDORADO GOLD CORP.								
China	Jinfeng	82	123 246	3.81	168 503	2 000 000	779	Guizhou Lannigou Gold Mine Limited (ownership: 18 per cent). Expected life of mine until 2026
China	Tanjianshan	90	101 451	2.70	107 614	288 000	779	"First Institute of Geology and Mineral Exploration of Quinghai Province (Qinghai) (5%), The Investment and Operation Company State–Owned Asset of Dachaidan Administrative Committee (Dachaidan) (5%). Expected life of mine until 2017"
China	White Mountain	95	73 060	3.13	85 308	571 000	779	"Jilin Provincial Geologic Survey Institute No.4 (Tonghua) (ownership: 5 per cent). Expected life of mine until 2019"
Turkey	Kişladağ	100	306 182	0.69	311 233	8 100 000	779	Expected life of mine until 2035
Turkey	Efemçukuru	100	90 818	7.23	98 829	1 000 000	779	Expected life of mine until 2023
The "All-in sustaining cash cost" equals 779 US$ per ounce sold in 2014 for the whole company								
GOLDEN STAR RESOURCES LTD								
Ghana	Wassa	100	186 000	2.04	113 000	1 578 000	778	
Ghana	Bogoso	90	145 000	2.52	148 000	350 000	518	

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
IAMGOLD CORP.								
Burkina Faso	Essakane	90	250 000	1.08	332 000	3 886 000	1 060	Government of Burkina Faso (ownership: 10 per cent). Expected life of mine until 2025
Suriname	Rosebel	95	336 000	0.86	325 000	3 155 000	1 045	Government of Suriname (ownership: 10 per cent). Expected life of mine until 2026
Mali	Sadiola	41	86 000	2.10	84 000	3 841 000	1 089	AngloGold Ashanti (ownership: 41 per cent) and Government of Mali (ownership: 18 per cent). Expected life of mine until 2017
Mali	Yatela	40	27 000	n.a	11 000	n.a	1 929	AngloGold Ashanti (ownership: 40 per cent) and Government of Mali (ownership: 20 per cent). Discontinued operations
Canada	Doyon division	100	63 000	7.10	82 000	539 000	1 031	
NEW GOLD INC.								
Mexico	Cerro San Pedro	100	102 795	0.55	69 847	215 000	1 354	
United States	Mesquite	100	107 016	0.56	106 670	1 679 000	1 266	
Canada	New Afton	100	87 177	0.59	104 589	760 000	610	
Australia	Peak mines	100	100 700	3.51	99 030	375 000	1 025	
PRIMERO MINING CORP.								
Canada	Black Fox	100	n.a	4.00	63 884	393 000	1 428	Acquired in December 2013. Data cover the period from 5 March 2014 to 31 December 2014
Mexico	San Dimas	100	143 114	5.70	161 170	818 000	826	
CŒUR MINING INC.								
Mexico	Palmarejo	100	116 536	2.27	86 673	488 000	n.a	
United States	Kensington	100	114 821	5.75	117 823	629 000	n.a	
United States	Rochester	100	30 860	0.12	44 888	518 000	n.a	
TERANGA GOLD CORP.								
Senegal	Sabodala	100	207 204	1.32	211 823	1 090 000	865	Expected life of mine until 2030

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
FIRST QUANTUM MINERALS LTD								
Mauritania	Guelb Moghrein	100	58 191	0.71	55 000 - 60 000	600 356	n.a	
JAGUAR MINING INC.								
Brazil	Turmalina	100	41 200	5.33	47 996	217 000	n.a	
Brazil	Paciência	100	9 987 (in 2012)	n.a	n.a	n.a	n.a	Care and maintenance since 9 August 2012
Brazil	Caeté	100	52 170	2.55	44 089	50 000	n.a	
HOCHSCHILD MINING PLC								
Argentina	San Jose	51	98 830	6.80	94 160	214 200	n.a	McEwen Mining Inc. (ownership: 49 per cent)
Peru	Arcata	100	16 830	1.00	16 890	67 900	n.a	
Peru	Ares	100	23 400	n.a	11 630	n.a	n.a	Operations suspended in June 2014
Peru	Pallancata	100	27 830	1.30	24 340	72 800	n.a	
ST ANDREW GOLDFIELDS LTD								
Canada	Holt	100	58 898	4.75	63 000	591 000	966	
Canada	Holloway	100	21 330	5.35	24 000	40 000	966	
Canada	Hislop	100	19 321	5.16	4 300	46 000	966	
The “All-in sustaining cash cost” equals 966 US$ per ounce sold in 2014 for the whole company								
AVOCET MINING PLC								
Burkina Faso	Inata	90	118 443	2.16	86 037	442 000	1 464	Government of Burkina Faso (ownership: 10 per cent). Expected life of mine until 2017
ST BARBARA LTD								
Australia	Leonora (Gwalia, King of the Hills)	100	273 000	6.90	285 030	2 280 000	n.a	
Papua New Guinea	Simberi	100	45 609	1.14	44 251	2 210 000	n.a	
Solomon Islands	Gold Ridge	100	45 931	1.60	45 121	670 000	n.a	Operations suspended in April 2014

Country	Mine	Owner-ship (per cent)	Production, 2013 (oz)	Recovered grade, 2014 (g/t)	Production, 2014 (oz)	Reserves, 2014 (oz)	AISC, 2014 (US$/oz)	Comments
NORD GOLD NV								
Burkina Faso	Bissa	90	254 300	1.52	250 700	1 675 000	570	Government of Burkina Faso (ownership: 10 per cent). Start-up: January 2013
Burkina Faso	Taparko	90	108 400	2.77	112 000	578 000	919	Government of Burkina Faso (ownership: 10 per cent)
Guinea	Lefa	100	162 700	1.22	205 100	2 600 000	1 133	
Kazakhstan	Suzdal	100	81 100	7.46	76 800	700 000	868	
Russian Federation	Berezitovy	100	120 300	1.62	122 800	644 000	713	
Russian Federation	Buryatzoloto	100	98 500	5.08	119 700	151 000	992	
Russian Federation	Neryungri	100	66 500	0.75	65 900	312 000	855	
Russian Federation	Aprelkovo	100	32 700	1.09	31 700	169 000	1 094	
ORVANA MINERALS CORP.								
Spain	El Valle-Boinás/ Carlés	100	65 992	4.29	62 957	302 000	1 160	
Bolivia	Don Mario	100	14 549	1.13	21 127	46 400	955	
ATNA RESOURCES LTD								
United States	Briggs	100	31 700	0.53	30 900	68 899	n.a	
MINERA IRL LTD								
Peru	Corihuarmi	100	25 223	0.30	23 654	20 000	n.a	
PETROPAVLOVSK PLC								
Russian Federation	Pioneer	100	301 600	0.85	319 900	2 910 000	970	
Russian Federation	Pokrovskiy	100	78 300	1.30	35 900	390 000	970	
Russian Federation	Malomir	100	158 700	1.03	92 200	3 070 000	970	
Russian Federation	Albyn	100	138 400	1.37	187 400	1 380 000	970	
The “All-in sustaining cash cost” equals $970/oz sold in 2014 for Petropavlovsk Plc								
TURQUOISE HILL RESOURCES LTD								
Mongolia	Oyu Tolgoi	66	157 000	0.32	311 000 (Jan to Sept)	11 900 000	n.a	Government of Mongolia (ownership: 34 per cent)
ENDEAVOUR MINING CORP.								
Burkina Faso	Youga	90		1.80	76 561	202 000	824	Government of Burkina Faso (ownership: 10 per cent)
Côte d’Ivoire	Agbaou	85		2.50	146 757	787 000	621	Government of Côte d’Ivoire (ownership: 10 per cent) and SODEMI (ownership: 5 per cent). Operations started in 2014
Ghana	Nzema	90		2.10	115 129	496 000	1 036	Government of Ghana (ownership: 10 per cent)
Mali	Tabakoto	80		3.90	127 323	807 000	1 335	Government of Mali (ownership: 20 per cent)

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