



Gold mining

Since Lydian merchants produced the first gold coins in 700 BC, gold has been an important part of the world's economy, but how is it mined and processed?



Have there been any recent shake-ups in the gold market?

The price of gold has remained roughly flat at US\$1,200 per troy ounce since August after falling from highs of US\$1,360 in January 2018, [that is until spot prices spiked, reaching over US\\$1,230 per troy ounce in early October.](#)

Gold prices are traditionally affected by geopolitical volatility and interest rates hikes, which push investors to gold as a safe haven from fiat currencies. Most recently, in the aftermath of the global financial crisis and under the influence of worldwide quantitative easing, these factors pushed gold to a record high of almost US\$1,900/oz in September 2011.

At the moment, gold is caught in the conflicting cross-currents of continuing Fed interest rate hikes in the US at the same time as the Indian Diwali festival creates its traditional, seasonal upcycle for gold.

As for mining, Barrick and Randgold's merger has captivated the news. Barrick has struggled since 2008, as evidenced by Randgold's share price being where its larger competitor's was 10 years ago and vice versa. Some see this as a vindication of Randgold's fundamental and geological approach to mining compared with the Goldman Sachs-style corporate capitalism of its erstwhile rival.

What are the geological features of gold?

[Now thought to be created by the merger of two neutron stars,](#) most of the gold on earth can be found in 32 commonly recognised deposits, which can be separated into exogenous and endogenous types.

Endogenic gold occurs beneath the surface of the earth. Some of the most commonly mined endogenic gold lodes are porphyries (a type of igneous rock) as well as in skarns. Skarns are geological formations created when rocks high in carbonates like dolomite or limestone are invaded by a high-temperature hydrothermal solution.

Exogenic gold is formed on the earth's surface and can be found in sands and gravel. Here, wind and water erodes rock formations, creating sands, gravels and sediments in which heavier elements like gold settle. Deposits of endogenic gold are, for the most part, found in streambeds, riverbeds and floodplains.

How is gold processed?

Some exogenic gold can be processed through smelting the metal together with flux, but hard rock ores require further processing.

First, the ore is crushed into a slurry, and then typically treated via cyanidation to dissolve the gold into a liquid alkaline cyanide solution, leaving the rock behind. The gold is then retrieved from the cyanide solution by adding activated carbon, a material to which gold adheres.

One former method of gold extraction is amalgamation via mercury, but it has fallen out of favour among commercial miners as a result of the detrimental health and environmental effects, but is sometimes popular with artisanal operators. After forming the amalgam, the mercury is then boiled away, leaving behind gold.

At this stage, the gold may be cast into a doré bar, containing 80-90% gold plus a range of other metals, such as silver, copper and iron.

How are doré bars purified?

Either the Miller or Wohlwill process is used to refine the doré bars. The Miller process heats the metal, then blows gaseous chlorine over the mixture.

The impurities bind with the chlorine to form compounds, which separate into easily removable layers on the surface of the molten gold to produce 99.95% pure gold.

To produce the highest grade of 99.999% pure gold, the Wohlwill process is used.

Here, unpurified ore is fashioned into an anode, and pure gold into a cathode. Electricity is then passed through a mixture of gold chloride and hydrochloric

Edison's insight:

'Recently, gold has been driven higher by a short covering rally. In the medium to longer term, however, it will be influenced both by moves in real US interest rates and the extent to which the Fed is successful – or not – in reducing the size of its balance sheet.'

Charles Gibson, mining analyst

acid. The electrical current collects the gold at the cathode, while impurities are left behind.

Where is gold mined?

Although South Africa was by far the world's largest producer of gold for most of the 20th century, it was overtaken by China in 2007, having fallen to seventh position from its previous heights. Much of China's gold is produced by mines in Shandong Province. It is also the world's leading gold consumer.

Australia is the second largest producer, with around two-thirds of its gold being produced from Western Australia, followed by Russia, the US, Canada, Peru and then South Africa. In terms of exploration, however, between 2006 and 2016, West Africa was a hotspot, attracting the largest exploration budget in the world after Canada and Australia and accounting for the most equity raised for exploration of any region bar Canada.

Who are the big players in gold?

Barrick Gold was the top gold producer in 2017, beating Newmont for the top spot and ahead of AngloGold Ashanti, Goldcorp and Kinross. Even so, the gold giant cut [its production from highs of 7.7Moz in 2010-11, to 5.32Moz in 2017](#). By comparison, Newmont grew its production by 7.6%, while AngloGold Ashanti grew its production by 3.4% alongside Polyus at 9.4%.

At the same time, Newcrest Mining, in seventh position and Goldcorp in fourth, reduced their production by 6.9% and 10.4%, respectively, for the year.

As for mid-tier companies, West Africa has been an attractive proposition. Among them, Canada-listed [Endeavour Mining has followed through on its aggressive West African strategy](#), developing its Houndé and Ity CIL mines. So has Teranga Gold, with its Golden Hill and Gourma projects.

In the same region, Nexus Gold Corp is highly involved in gold exploration in Burkina Faso, while [Galane Gold plans to restart its Galaxy mine in South Africa by the first quarter of 2019](#).