Gold has long been one of mankind’s most prized possessions. Yet most people have little idea where gold comes from, other than from “gold mines.”

Mining gold today often becomes monumental undertakings, truly some of man’s greatest engineering feats. Imagine gold mining shafts nearly two and a half miles below the surface and it taking two hours for miners to get to their work stations. Imagine a pit so large that it can be seen from outer space.

No reason to imagine, those are the realities in the mining of gold revealed in “The World’s 10 Most Prolific Gold Fields.”

1. Witwatersrand Basin (Johannesburg, South Africa)

The head frame of the Tau Tona Mine is the lone entrance to over 500 miles of tunnels.

Located in South Africa, the Witwatersrand Basin represents the richest gold field ever discovered. It is estimated the 40% of all of the gold ever mined has come out of the Basin. In 1970, South Africa’s output accounted for 79% of the world’s gold production. By 2009, South Africa’s share of world gold production had dropped to less than 8%.

Mining in the Witwatersrand Basin is accomplished by creating deep underground tunnels that are necessary to reach the plentiful reserves. The Tau Tona Mine features the deepest tunnel in the world extending a full 2.4 miles below the earth’s surface. A massive ventilation and air conditioning system is required to overcome the extreme working conditions throughout the over 500 miles of tunnels. At its deepest levels, the air temperature reaches 131 F and the rock face itself 140 F. The mine is so extensive that it takes workers a full two hours to travel from the surface to the deepest sections of the mine where they must then contend with pockets of lethal gas, water and a continual barrage of small earthquakes.
The discovery of gold in the Basin in 1886 by Australian miner George Walker set off one of the largest gold rushes in history. The surrounding area became the city of Johannesburg, and within ten years Johannesburg was the largest city in South Africa. The huge influx of foreigners (mostly British) created resentment among the Boer (prior Dutch settlers). Imposition of heavy taxes and restriction of voting rights by the Boer led to the Second Boer War in 1899.

2. Carlin Trend (Nevada, US)

A large open pit excavation at the Twin Creeks Mine in the Carlin Trend.

For over a hundred years, prospectors in the Western US completely missed one of the richest gold fields in the world as it contained what is now popularly called ‘invisible gold.’ Historically, most gold fields were discovered by the presence of gold veins or deposits visible to the naked eye. Not so in the Carlin Trend located in northeast Nevada. Hot springs containing dissolved gold deposited the metal into the sediment in such fine particles that it is difficult to see even with a microscope and impossible to find using older conventional methods such as hand tools and panning.

In 1961, John Livermore, a geologist for Newmont Mining, set out in search of this invisible gold based on some ideas in a paper published a year before by noted geologist Ralph Roberts. It didn’t take long before Livermore found what he was looking for in an area that is now known as the Carlin Trend. The deposit was the first major one of its kind discovered. Subsequent discoveries of similar type areas in China and Macedonia are referred to as Carlin Trend type deposits.
Mining by Newmont began in 1965; the area has since become one of the richest gold fields in the world. Open pit mining dominates the Carlin Trend over its five by 40 mile area although some underground operations have been formed in higher grade areas.

Gold production in the state of Nevada, which is dominated by the Carlin Trend, accounts for almost 80% of the gold mined in the United States. If Nevada were a country, it would rank #4 in the world in terms of total gold production.

3. Irian Jaya (Indonesia)

*The Grasberg Mine’s opening is 1 mile in diameter.*
In one of the most inaccessible spots on the planet lie the single largest gold ore body and third largest copper ore body ever discovered. Located in the mountains of Irian Jaya, Indonesia, at an elevation of 14,010 ft, is the Grasberg Mine. Two miles away lies its predecessor, the Ertsberg Mine. The amazing feat of their construction by Freeport McMoRan is the subject of an episode of Discovery Channel’s Super Structures.

Work on the original Ertsberg Mine began in 1967 with the construction of a dock and a 25 mile road through the surrounding jungle. Chain saw wielding workers were lowered from helicopters to cut their way clear to the jungle floor. Bulldozers were flown in where they often had to contend with 20 feet of soft marshland before reach solid ground. The final section of mountain road was built atop a ridge so narrow that the first clearing pass had to be done with bulldozers no bigger than riding lawn mowers. Six subsequent iterations of air lifting increasingly larger bulldozers were used to complete the road. A tram system had to be built to surmount the final 2,000 foot cliff that separates the road from the mine site.

Getting the mined ore off of the mountain is a much more efficient process: it is simply dropped 2,000 feet to the giant crushers below. The processed ore is mixed with water to create a gold and copper slurry which travels through 70 miles of pipe out to the shore. From there, the slurry is concentrated and the ore then transported to smelters around the world.

The original Ertsberg Mine operated from 1972 until it was depleted in the mid 1980s. In 1988, Freeport McMoRan discovered the enormous neighboring ore body that is today operating as the Grasberg Mine. Gold production was 2.5 million ounces in 2009. Open pit operations will continue through 2015 at which point the gold will be mined by underground methods.
4. The Super Pit (Kalgoorlie, Western Australia)

A view of the Super Pit from a turn off on the Goldfields Highway.

The Super Pit, located in Kalgoorlie, Western Australia, is the largest open pit mine in the country. It covers an area of almost three square miles and is large enough to be seen from space. The excavation began after several underground mines were acquired by Kalgoorlie Consolidated Gold Mines. Even today, operations occasionally unearth old mining tunnels complete with abandoned mining equipment.

The Super Pit covers an area known as the Golden Mile, a name that dates back to the original gold rush of the late 19th century. During this time, the field was considered to be the richest square mile in the world. The area has been continually mined for over 100 years, and the Super Pit is expected to remain in production through at least 2017. Once retired, the mine will be allowed to fill in with ground water, a process that could take 50 years.
The city of Kalgoorlie was formed in 1893 right after Irishman Paddy Hannan filed a Reward Claim leading to an influx of hopeful prospectors. The subsequent gold rush saw the surrounding area boom over the next 10 years, temporarily reaching a population of almost 200,000. It was during this time that Kalgoorlie’s famous Hay Street brothels began. Much like the mine, they have also been in continuous operation for over a century and are now an accepted part of the community. Today, Kalgoolrie has a population of less than 30,000 with about one fourth of its jobs directly related to mining.

5. Yanacocha (Peru)

Located high in the Andes Mountains, with parts reaching elevations in excess of 13,000 feet, lies the sprawling complex known as Yanacocha. Covering some 60 square miles, it is the largest gold mine in Latin America, possibly the second largest in the world, and is recognized as one of the most profitable in the world. Yanacocha is the largest facility operated by Newmont Mining and is the company’s crown jewel. With almost $2 billion dollars invested in the mine, Newmont has received a return of over $7 billion to date.
In 1994, a legal battle for Yanacocha erupted between Newmont Mining and its French partner BRGM after BRGM attempted to sell its stake to a Newmont rival. A controversial decision by the Peruvian high court allowed Newmont and its Peruvian partner Buenaventura to buy out BRGM’s stake. The aftermath was ugly with both sides accusing one another of engaging in improper conduct in attempting to influence the decision.

Since its origins in 1993, Yanacocha has produced more than 26 million ounces of gold.

6. Gold Country (California, United States)

*The Kennedy Gold Mine which operated from 1870 until 1942.*

Gold Country is the casual name given to the area on the western slope of the Sierra Madre Mountains extending along what today is Highway 49 in California. It was the discovery of gold here in the tailrace at Sutter’s Mill that triggered the famous California Gold Rush of 1848-1855. Within only a few years of the discovery, nearly 300,000 people made the trek to California to seek their fortunes. San Francisco grew from a population of 1,000 to 25,000 by 1850.

Initially, prospectors focused on panning for gold but later moved to hydraulic mining in which pressurized water was used to loosen sediment along slopes and cliffs for processing. It is estimated that some 20 million ounces of gold was collected using these labor intensive methods.
The Kennedy Gold Mine which operated from 1870 until 1942.

Eventually, the gold rush period gave way to conventional hard rock mining. This required the intensive capital investment provided by companies. Mines in the area continued to operate up through WWII when the government forced their closure to direct resources for the war effort. One such operation was the Kennedy Gold Mine in Jackson, which by 1920 contained a remarkable 150 miles of underground tunnels reaching depths of 5,912 ft. After the war the mine lay dormant until 1961 when the 152 acre property was purchased by a ceramics teacher for $41,600 who lived there until her death in 1994. Now, it is preserved as a historical site.

When the price of gold soared in the 1970s, interest in the area renewed and several mines were opened using the more modern method of open pit mining. In some cases older tunnel mines were excavated. By the late 1980s, most of these mines had ceased operations due to the depressed price of gold. One in particular, the Harvard Mine near Jamestown, continued operations until 1995 with production in excess of 100,000 ounces of gold per year.

7. Homestake Mine (South Dakota, United States)

When the Homestake Mine of Lead, South Dakota ceased operations in 2002, it was the largest and deepest gold mine in the Western hemisphere. Total output over 125 years of continuous production amounted to nearly 40 million ounces of gold.
The Homestake Mining Company was formed in 1877 when George Hearst, father of media mogul William Randolph Hearst, purchased the initial 10-acre claim for $70,000. Through a relentless series of acquisitions, he eventually secured control of 8,000 acres. During this time more than one person who refused to sell a claim or spoke out against him met with violence. In one case an uncooperative claim owner was killed by a Homestake Mining employee, who was later acquitted after the witness disappeared. The HBO series Deadwood is the fictionalized account of this period.

The Homestake Mine was also the site of significant research in particle physics. In the late 1960s, Raymond Davis Jr. headed up the team that was the first to successfully detect and count solar neutrinos using a large collector located deep in the mine. These experiments operated continuously until 1994. In 2002, Davis shared the Nobel Prize in Physics for his work at the Homestake site.

In 2007, the National Science Foundation gave its approval to build the Deep Underground Science and Engineering Laboratory (DUSEL) in the Homestake Mine utilizing its full 8,000ft depth for research. As of 2011, no construction date has been set.
8. Lihir Island (Papa New Guinea)

Aerial shot of the Lihir Gold Mine.

In just how exotic and remote of a location can you find one of the world’s largest gold mines? If you start from Port Moresby, Papua New Guinea and head 500 miles northeast across the Bismarck Sea you will reach the tiny Lihir Island on the other side of New Ireland. It is on the east side of the island that Newcrest Mining operates its appropriately named Lihir Gold Mine.

The island’s 125 square mile area was formed from a volcano rising 2,300 feet above sea level. Gold was initially discovered during explorations in 1983, and production began in 1997. With operations so close to the water table, large bore pumps must be used to keep the mine from flooding.

The mine itself is located over an active geothermal area. Holes have been drilled to relieve the pressure and the gases are used to power a generator which supplies 75% of the mines energy requirements. Future expansions include the possibility of using the geothermal energy to power 100% of the facility.

Improvements to the mine should allow it to produce one million ounces of gold per year through 2020. It will then switch over and spend the next 17 years processing stockpiled lower grade ore. Total resources are estimated at 40 million ounces.
9. Dawson City (Yukon Territory, Canada)

Gold Dredge #4 which operated in the Yukon from 1913 to 1959.

In July 1897, the newspapers in San Francisco picked up the story of miners from the Yukon arriving at the dock with bags of newly mined gold. From that point, the Klondike Gold Rush was on. Over 100,000 hopeful ‘stampeders’ set out on the perilous journey to Dawson City, but only about 30,000 ultimately made it.

The trek to the Yukon began with an easy boat trip from the US west coast to Skagway in Alaska. However, from there the stampeders had to cross the incredibly steep Chillkoot Pass — a staircase made of ice and snow that rose 1,000 ft in the last ½ mile, making the pass impossible for pack horses. Miners had to carry up their supplies over multiple trips.

Making this task all the more difficult was the fact that the Royal Canadian Mounted Police would not allow anyone to enter Canada without a year’s worth of food and supplies. This amounted to 2,000 lbs per stampeder. For those who actually made it over the pass, a three-week 500 mile boat trip up Benett Lake to Dawson City awaited them. The only problem was the stampeders actually had to construct their own boats or rafts on the spot. Many broke apart on the rapids.

Mining for gold in the Yukon was as difficult as getting to the Yukon. Most of it was located ten or more feet underground. Digging could only be done in the summer and even then a hard layer of permafrost had to be breached first. Temperatures in the winter reached -60F.

In the early 1900s, commercial dredgers began to dominate the area. These were large floating mines that scooped material off the river bottoms onto screens where the heavier gold could be separated. Waste material was the discarded out the back. Up to 24 of these dredgers operated in the Yukon all the way up until the 1950s. It is estimated that some 12.5 million ounces of gold was recovered from the area.
10. Hishikari Mine (Japan)

A miner poses in front of a massive gold vein at the Hishikari Mine.

In the 13th century, Marco Polo described Japan as ‘the land of gold’ based on what he perceived as plentiful displays of gold throughout the King’s palace and stories from traveling Muslim traders. Historically, most of Japan’s gold was produced from only two mines and by the early 1980s there was virtually no commercial gold production in the country.

That changed in 1981 when Sumitomo Metal Mining Co. discovered the highest grade gold ore deposits in the world in what would become the Hishikari Mine. In mining exploration, the rule of thumb is three ore strikes for every 1,000 test bores drilled. When Sumitomo drilled 21 bores in the area all 21 came up with strikes – and not just any ore — the gold concentrations averaged six to ten times higher than that typically seen in commercial gold mines.

The secret to these ultra high concentrations lay in Japan’s unique volcanic geology. Over the last million years, rising pockets of magma and hydrothermal fluid deposited massive vertical veins of gold and quartz. These veins can run more than three feet wide, 400 feet high and 325 feet deep. So far, 87 of these veins have been mapped out at Hishikari.

In just the last 25 years, output from the Hishikari Mine has more than doubled the previous 400 hundred years of production from Japan’s two formerly largest mines and new reserves are still being discovered there today.