

an unique example, and although a very minute creature, may prove valuable addition to the Cabinet of this Institute in which it will be placed.

ART. VI.—*Gold and its separation from other Minerals.* By
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Gold has long been known and esteemed as the most precious of all the metals. From the earliest ages of antiquity, it has been employed to decorate the human person, ornament temples, and cast into coins. It now forms the true standard by which other substances and property of all kinds are valued. The history of gold is one of peculiar interest. This metal formed the chief adornments of Solomon's Temple. The sacred vessels that "pertained to the House of the Lord," the altar, the table, the candlesticks, the lamps, the censers, and even the hinges of the doors of the temple, were of pure gold. The walls of the New Jerusalem, as described by the Apostle St. John, were of twelve precious stones, "and the building of the wall of it was of jasper, and the city was of pure gold, like unto clear glass."

Some of the Israelites and the nations around them, had their idols of gold and silver; and up to the present day the images worshipped by idolatrous nations are made of gold, whenever that metal can be obtained; and it is to be feared that gold is the god of many, after it has been stamped into coin.

It is not, as some have supposed, that the scarcity of the precious metal imparts to it its great value. Gold is the most malleable of all metals. It is easily worked by the smith, and will not oxidate or rust under ordinary circumstances. Whether buried in the earth, or in the sea, it remains unchanged. In ancient times Ophir was celebrated for its gold. It occurs in the East, and Africa has its golden sands, the continent yielding to the amount of 5,000 pounds avordupois annually. It is now found along the slopes of almost all the mountain ranges of the earth. It occurs in the mica slates of the Tyrol. In Siberia it appears in alluvial sand; and in the country eastward of the Ural Mountains, masses of gold have been found weighing from ten to twenty pounds. The mines of Hungary, Transylvania, and those of the Alps, are worked for their gold. Scotland and Ireland have deposits of the precious metal. It has also

been discovered at several places in England, and at Devon it is found in the stream tin works ; but the gold of England and Scotland is in their coal, iron, tin and copper.

The annual gold produce of Hungary is valued at £470,000 sterling. The mines of Spain, formerly rich in the noble metal, are now much neglected, from the increased cost of deep mining, and she still receives much of her gold from Mexico. The sands of the Danube, the Rhone, the Tagus, and other European rivers, contain gold, but the quantities they possess will scarcely pay the cost of working. In some of these sands the spangles of gold are so thin that one thousand of them will not weigh a grain.

The gold mines of Russia, or rather those of Asia, are eastward of the great barrier of the Ural Mountains. Here the matrix of the metal is in general a coarse gravel, and much gold is found in the *debris* of the surface. The great marshy plain on the banks of the River Tacknou Targeuma, is rich in gold, and the houses have been removed to obtain the precious metal. In 1842, at the depth of three yards, under the corner of a building, a mass of gold was dug up which weighed upwards of 36 kilogrammes, or 80 lbs. English. This specimen is now in the collection of the Corps des Mines, at St. Petersburg. It has been stated by Sir Roderick Murchison, that the reign of the Emperor Nicholas, has been distinguished by the important discovery that portions of the great eastern divisions of Siberia are highly auriferous. The total produce of gold in the Russian Empire, now exceeds £5,000,000 sterling annually.

Long before the treasures of California were discovered, America was celebrated for her gold mines. The gold region of the American States extends along the eastern slope of the Apalachian chain of mountains, from the Rappahannock, in Virginia, across the State of Alabama, and along the flanks of the mountainous country, known as the Blue Ridge. In this quarter, the most productive labor has been that applied to the sands of river beds, where few machines, except rockers, are required.

Spurs of the Alleghany mountain chain extend into Canada and New Brunswick, and the central granitic ridge of Nova Scotia is composed of rocks similar to those of other auriferous countries.

In South America, the gold is found on both sides of the great mountain ridges that run nearly parallel with the coasts. The precious metal is gathered from the beds of streams flowing from the lofty heights of the Andes, and the volcanic *foci* along its flanks.

Gold is widely disseminated in Peru, Bolivia, and Chili. Along the sides of the Rocky Mountains, in North America, gold has been found at a

number of sites. At Whitehall mine, in North Carolina, gold to the value of \$10,000 was obtained in the course of five days, and in a space not exceeding 20 feet square. The gold of the Rappahannock appears to be confined to a space 200 yards wide and about 1,000 yards long. A profitable quantity of gold exists in rock, which has no appearance or indication of the precious metal whatever. The present unhappy war has stopped the working of the mine, which is situated near Fredericksburg, and the surrounding country is now the theatre of rapine and bloodshed.

In 1847, gold was discovered on the property of Capt. Sutor, a wealthy Swiss immigrant, who had settled on the banks of the Sacramento river in California. A contractor for building a mill observed the glittering particles in the sand of a stream. The tidings flew upon the wings of the wind; the town of San Francisco was nearly abandoned by its inhabitants; the crews of ships deserted, and every kind of population proceeded to search for the promised riches. The news went rapidly abroad, and there was a rush of emigrants, Jews, Turks, and infidels, as well as christians from all nations, to share in the search for wealth. The half-civilized country was soon overspread by gold-seekers. The gold was found in digging a well at San Francisco, and then a hundred miles off, it was dropping from the cliffs into the sea, and slowly settling through the sands of the shore. The seekers had to dig pits, to climb mountains, to turn rivers, to sink shafts, to run galleries, to uncover plains, to break, crush, shake, wash, to amalgamate and distill. Seven Mexicans realized in a few days \$217,000 dollars. In the course of the five succeeding years thirty millions of gold were poured into the commercial world. The results of the discovery are well known, and among them is the fact, that of multitudes that went to California, few made fortunes—many were ruined, and returned to their friends and families penniless, and numbers were buried in the sparkling sands of the Pacific coast.

But, before the world had recovered from the California excitement, it was announced that Australia was a land of gold; and although Great Britain had received the lion's share of the American gold, she had a special interest in her Australian colony. The first discovery in that quarter was made by Messrs. Stutchbury and Hargraves; the latter washed gold from buckets of earth. Results similar to those which had taken place in California, followed in quick succession, and thousands who had been engaged on the Pacific shores sailed away to the new El Dorado. Gold was found in surprising quantities. Lumps of the metal were picked up, and it has been stated that a poor man who went to the diggings, with only a forked stick and a frying pan, raked up £5 worth of gold in half a day.

Besides the gold field in the neighbourhood of Sydney and Bathurst, at Buninyong, 80 miles from Melbourne, and 50 from Geelong, 8 square feet were supposed to be ground enough for any man to make a fortune. One man found \$1500 worth of gold in a week, another £1000 in the same time, and a party of three had met with 20 lbs. in weight in one day. Thousands of all classes hastened to this land of promise. Ships were deserted, and to man the Commercial Marine the jails were opened to the relief of sailors who had been confined on short sentences. The scenes that occurred are perhaps more indescribable than the mines themselves.

Next in order comes the finding of gold in Nova Scotia, which took place in 1861, near Tangier. This discovery was immediately followed by others in different parts of the Province, and along certain lines of strata belonging to the metamorphic group of rocks, and to great extent. Subsequently new gold fields have been discovered from time to time. The metal has also been washed from some of the river sands, and the superficial drift of the country. Nuggets have been found from \$100 to \$500 in value, and companies and individuals are now engaged in mining. I have visited almost every mine in the Province, and I am led to the belief that the resources of the metal in Nova Scotia will be found to be enduring and remunerative. As usual, from the commencement, many of the farmers deserted their ploughs, tradesmen their tools, and professional men and merchants embarked in searching and mining for gold. The government also proceeded to grant licenses to the numerous applicants for auriferous grounds. The prospects are now favorable, and when capital, science and skill shall be more widely introduced, this island-like Province will prove to be a still more happy home for her people, and a rich appendage of the British Empire.

Scarcely had a year passed by, after it was known that Nova Scotia was an auriferous country, when it was announced that the noble metal existed on the shores of Fraser's and Thompson's rivers, in the Territory of the Hudson's Bay Company, in British Columbia; and, from the accounts which have been received from that quarter, it was evident that gold is also abundant in that part of Her Majesty's dominions. Notwithstanding the remoteness of the country and the severity of the climate, the hardy gold-seeker has found his way to the tops of the mountains and depths of the vallies, and the riches of the earth accompany the furs of the Arctic regions homeward to a market.

The latest gold discoveries of importance are those reported from New Zealand, in the South Pacific Ocean, into which there has already been an influx of immigrants searching for the metallic riches of the remote

Islands. Thus, in the course of 15 years, profitable quantities of gold have been found in no less than five different countries.

California in	1847
Australia in	1851
British Columbia in	1860
Nova Scotia in	1861
New Zealand in	1862

When the gold of California began to pour in its harvest, many were the prophecies of ill that would befall the world. It was thought by many that the sudden influx of the coveted metal would demoralize the nations, derange commerce, and finally lose its value; but the gold-seekers and gold diggers have gone on, and none of the results from the cause apprehended have taken place. Indeed, to the contrary, the American States, in which the metal is abundant, seek it at a premium of 50 per cent above its ordinary value against their National paper money. Like silver, gold will probably never lose its value as coin, for the instant its price falls a little below the ordinary rate it is converted into jewelry and articles of luxury, for which all nations have a fancy.

The annual amount of gold added to the metallic wealth of Christendom at the beginning of the present century, amounted in round numbers to about \$15,000,000; in 1848 it rose to nearly \$40,000,000; at present it is about \$190,000,000. The total quantity of gold obtained on the whole continent of America, from the era of Columbus to the discoveries in California, amounted to two billions of dollars. One-tenth of this sum is now added annually to the commerce of the world. Sir Roderick Murchison, the distinguished geologist, in an address delivered in London in 1847, asserted that the gold of California would be constantly on the decrease. He stated that all gold veins on the surface of the earth diminish and deteriorate downwards, and can rarely be followed to any great depth, except at a loss to work them. "As the richest portions of the gold ore have been aggregated near the upper portions of the original vein-stones, so the heaps of gravel, or *detritus*, resulting either from abrasion or tear and wear of ages, and derived from the surface of such gold-bearing rocks, are, with rare exceptions, the only materials from which gold has been or can be extracted to great profit." Since the above period, that gentleman has greatly modified his opinions, as gold has been found in quantities yielding profit at very considerable depths in the earth; and improved methods in the application of mercury and machinery, under the direction of science and skill, now gain profits from ores which formerly did not pay the cost of working. Taking all the recent

discoveries and improvements in working into consideration, it is reasonable to conclude that the quantity of gold will be augmented rather than diminished in years to come. Since the early part of 1861, reports have been circulated through the medium of scientific papers, that a chemist in France had succeeded in making gold from the baser metals. It has also been reported that Napoleon the III. had purchased the secret; and political apprehensions have arisen, from the power thus placed in the hands of the French Emperor. Gold is a simple substance, and differs from all other metals—and although it may be imitated in color, it has a specific gravity, and other characters beyond the reach of composition. As the philosopher's stone has not yet been discovered, the world need have no fears of the riches of France; indeed, the efforts of the Emperor to obtain the gold and silver mines of Mexico, do not indicate that he possesses the power of manufacturing the metal at home.

Gold is found in the sands and mud of rivers and rivulets, in the boulders and diluvial drift of the surface, diffused over plains, and collected in rocky chasms and fissures. It occurs set deep in friable and compact quartz, mixed with desintegrated granite, or forming a garnish on micaceous and argillaceous slates. The mode of its extraction must always conform to the conditions in which it occurs, and these conditions are various. Among the sands of rivers and diluvial *debris*, with a pickaxe, shovel, pan and cradle, a man may gather more than ordinary wages; but even here hydraulic engines are necessary. But, in the flinty veins of rock, individual industry is lost without the aid of all the appliances of mining and the best modes of extraction; hence the absolute necessity for the expenditure of capital, in order to render the work profitable.

Gold is always widely and meagrely disseminated, and generally a large quantity of material must be mined, broken and pulverized, before even a small quantity of the gold can be obtained. The individual miner may occasionally find a valuable nugget, but these are few and far between, and frequently mislead him into rash speculations and expensive labor.

In Nova Scotia, the principal part of all the gold discovered, has been found in exceedingly hard veins of quartz, and overflown masses of that siliceous mineral. So far, comparatively small quantities have been obtained by washing the river and beach sands, and the diluvial *debris*; and for this object, almost the only means employed have been the common cradle and pan. The improved instruments for this purpose are the large cradle, and what is called in California and Australia, the "Long Tom," and the "Hydraulic Jet."

From the fact that Ophir signifies a place of ashes, it has been inferred

that the ancients employed heat only in the separation of gold from its matrix, and by a method still practised by the Persians. Gold dissolves speedily in mercury, at ordinary temperatures; and the Spaniards were probably the first to adopt the process of amalgamation, which is the cheapest mode of operation upon large quantities of material. The Mexicans grind the auriferous rocks and mercury together in rude stone basins, surmounted by heavy rollers, and the Spanish raster, so called, is still in use. The amalgam, when formed, is collected and distilled in iron retorts, the quicksilver passing over into a receiver, and the gold remaining in nearly a pure state in the retort. But in order to obtain an amalgam it is necessary that the gold and mercury should be brought together in absolute contact, and therefore it is important that the rock should be finely powdered, before the mercury is applied. For this object various kinds of crushers have been invented, and of them, none have been found more useful than the common stamper, now in general use. (Several kinds of crushers and amalgamators were exhibited, with a variety of gold ores from Foreign Countries, and a beautiful wreath of the gold of Nova Scotia.)

To extract every particle of gold from quartz by amalgamation, is a very difficult operation, and one that requires time and much experience; yet like all other inventions which have not been brought to perfection, almost every miner professes to have a knowledge of the art. Already have a number of the schemes introduced into Nova Scotia, to remove the gold from its gangue failed, and some of them have been relied upon without any knowledge of mechanics, chemistry, or the properties of matter. In California and Australia, companies have been successful in obtaining gold, by following those who had first crushed the rock, or cradled the sand, and from the tailings of the first adventurers, fortunes have been won. In regard to the richness of quartz, the expectations of the miner are always too high; and as a general rule, excepting in rare instances, it is only by the continued operations of well-conducted labor and machinery upon meagre rock, that large amounts of gold are obtained. I have no doubt the time will arrive when the various interests of many parties now engaged in gold mining in Nova Scotia, will be more or less united, and the work of extraction will be successfully performed. In the mean time, the gold-seekers will extend the present discoveries,—men and machinery will come in and prevent the abandonment of other useful pursuits and branches of industry, such as agriculture and the fisheries,—and finally, by the united efforts of all, under a wise and harmonious government, the Province will lift up her head, and shine as one of the brightest gems of the British Empire.