

THE FUTURE OF GOLD.

AFTER the year 1850, when California and Australia were sending out into the world annually about thirty-five millions sterling in gold, Michel Chevalier and Cobden raised the cry of alarm: the world would be completely submerged by a deluge of gold. After 1867, the production of gold rapidly diminishing, an entirely opposite fear gradually gained ground amongst far-seeing business men. In 1869 in the review of the preceding year, the *Economist* wrote: 'It may safely be affirmed that the present annual supply of 30,000,000*l.* of gold is no more than sufficient to meet the requirements of the expanding commerce of the world. The real danger is that the present supply should fall off, and amongst the greatest and most salutary events that could now occur would be the discovery of rich gold deposits.'

In 1871, after the decision of Germany to proscribe silver, the uneasiness of the *Economist* increases, and it writes thus: 'As the annual supply of gold is reckoned at little more than 20,000,000*l.*, and the annual demand for miscellaneous purposes is very large, it follows that if the German Government perseveres in its policy, the strain upon the existing stocks and currency will be most severe. Unless the annual production of gold should suddenly increase, the money markets of the world are likely to be perturbed by this bullion scarcity.'

What the *Economist* foresaw has taken place. The scarcity of gold has induced so great a fall in prices that they are now lower than in 1850. Mr. Robert Giffen clearly showed this in an excellent study which has never been disputed, but which has, on the contrary, been confirmed by such men as Thorold Rogers, Patterson, Samuel Smith and Williamson of Liverpool, John Hector, T. Smith, and many others. Who can doubt that the present crisis from which the entire world is suffering is due to the scarcity of gold? Up to the present time, exchanges have been effected in civilised countries by means of two metals, gold and silver; to-day, the coinage of silver having been suspended, except in India, the stock of money in the world is now only fed by gold, and at the same time the production of gold is yearly diminishing, and, what is worse, for the last three years America has taken for herself more than sixteen millions annually—that is to say,

the whole total production, less four millions, which do not suffice to cover even industrial wants. Bagehot estimated that England absorbed yearly for industry and coinage from four to five millions sterling. On the contrary, in 1879 England exported a surplus of gold, amounting to 2,389,826*l.* and in 1880 4,249,449*l.* The coinage in Europe has now sunk to almost nothing. In France the coinage of gold, which amounted in 1877 to 271,645,425 francs, and in 1878 to 189,139,520 francs, sank in 1879 to 24,610,540 francs. In England last year the amount of gold coined was quite insignificant, 35,000*l.* only. Silver can no longer, as recently, help the circulation and effect exchanges, for it is no longer admitted at mints. The production of gold, which was thirty-five millions annually some years ago, does not now exceed nineteen or twenty millions. It is clearly evident that these circumstances united—viz. the proscription of silver, the decrease in the production of gold, and the draining of gold to America—have led to an appreciation of gold, a fall in prices, and to the present crisis, as the inevitable consequence of monetary contraction.

This being the case, it is of the highest importance that we should carefully examine if the production of gold is destined to increase or diminish, for the economic conditions of the whole civilised world are dependent on this. If more gold be not found, silver still being proscribed, prices will continue to fall. Prices falling, the burden on all those owing gold will increase, for they will be forced to sell more articles to obtain the same quantity of gold; farmers will have more and more difficulty in paying, for the produce of their farms will lose in value; manufacturers will be exposed to heavy losses, for while converting the raw material into manufactured goods, the general fall in prices will make itself felt, and the manufacturer will in all probability find himself working at a loss.

It would be rash to predict, with too great certainty, anything definite with regard to the future of gold; nevertheless, taking as a basis ascertained historical facts, and geological researches with respect to the earth's crust, it is not impossible to arrive at certain conjectures which may be at least looked upon as probabilities. This is what an eminent professor at the University of Vienna, Dr. Suess, has attempted to do in a work entitled *Die Zukunft des Goldes* (*The Future of Gold*). This book attained a very high reputation throughout Germany, and has been successful in convincing some of the most able economists that it is essential to restore to silver its attribute of money, of which it never should have been deprived. The conclusions Dr. Suess reaches are as follows: The production of gold will in the future diminish and the mines become exhausted the more rapidly as the present means of working them are more perfected and powerful. The discovery of new mines in hitherto unexplored regions may, for the time being, stop this ex-

haustion, but the expanse of new country where we may hope to meet with these mines is rapidly diminishing, and in the parts previously colonised, mines once very productive are being one after another abandoned. We will examine how Dr. Suess treats these different points.

Gold and silver are essentially the 'precious metals' from the mere fact of their being rare. The scarcity of gold is certainly the chief cause of its value. But can it be explained why gold is so rare? According to Dr. Suess, it is because gold is one of the heaviest metals. Three metals are noted for their extreme density—iridium, platinum, and gold. Their weight compared to water taken as a unit is represented by the following figures: iridium 22.23, platinum 21.50, gold 19.253. With the exception of that strange and also rare metal, mercury, the density of which is 13.59, gold and platinum weigh more than any other metals; for, as an instance, lead reaches 11.35, silver 10.47, bismuth 9.82, copper 8.80, nickel 8.27, and iron only 7.84. Is there a connection of cause and effect between these two facts, that gold is a rare metal and, at the same time, one of the heaviest that exist? One would be inclined to think that there is, if one admit that the earth was first in a gaseous and afterwards in a liquid state. In this case the heaviest matters must have occupied the centre of the globe in a smelting condition. If it be true that our whole planetary system has been formed from matter, which constituted in the beginning an immense nebula, it follows that the planets the nearest the centre must be the heaviest. These ideas were brought forward by the great German philosopher Kant about the middle of the last century, and have been from time to time referred to since. 'The great weight of platinum and gold,' says a German naturalist, Petzholdt, 'is the reason for these metals being so scarce on the surface of the globe, for the greater quantity of them is contained in the still liquid kernel of the earth, there shielded from men's greediness.'

Some observations that have been made help to support these ideas. The spectrum analysis reveals no gold in the sun; we may therefore conclude that it is quite in the centre, hidden from view by other lighter bodies in a gaseous state forming the photosphere. The planets may be divided according to their weight into two groups. The planets in the interior of the circle of asteroids are comparatively heavy, those exterior are comparatively light. Mercury, the nearest to the sun, weighs almost seven times as much as water; Venus, the Earth, and Mars, five times as much; while Jupiter weighs barely as much as water; Saturn 0.73 and Uranus 0.84, therefore less than water. The density of Neptune, which has not been quite accurately determined, is at all events very trifling. So we see that in our planetary system the heaviest bodies are the nearest to the centre, and this leads us to assume that the same distribution of matter will be found in each planet. As the rocks form-

ing the surface of our globe weigh on an average $2\frac{1}{2}$ times as much as water—limestone 2·6 to 2·8, granite and gneiss 2·54 to 2·7, and lava or basalt 2·7 to 3—and as, on the other hand, the specific gravity of the globe is five, we are necessarily led to conclude that the interior must be composed of heavy matter, far exceeding in weight the earth's average of 5. The existence of gold in the central strata of our globe appears, therefore, very probable.

But if this be the case, how can we account for gold and platinum being found on the surface of the earth? It can be explained by the action of hot springs and volcanoes. These two heavy metals are always found amongst rocks of an igneous origin—here where volcanic rocks have pierced through and scattered earlier formations, and there where granite has broken up schists. Platinum, which has only been found in abundance in the washings of Nijni-Tagil in the Ural, comes from the serpentine, a rock coming from the depths. Gold is chiefly found in quartz veins. These veins appear to have been formed in the following manner. As a natural consequence of the contraction of the earth's solid crust, and of the upheaval and disturbance of the previous formations, crevasses have formed themselves. They have become filled with quartz, sometimes auriferous, either by the action of hot springs or by sublimation. In these veins, usually poor, exceptionally rich zones are here and there to be found; German miners call them 'edle Säulen' (noble columns), and Americans 'bonanzas.' It is the working of these bonanzas that renders veins profitable, which generally contain, apart from them, so little gold that the miner literally works at a loss. If the work be continued it is in the hope of coming upon one of those rich zones, which sometimes far more than compensate for any former deficit. The extreme scarceness of gold that can be dug up is therefore a fact, and a fact easily accounted for when we consider its distribution and the geological origin of this metal.

Let us now recall some historical facts which lead Dr. Suess to conclude that the production of gold will diminish in the future. The soil from which we obtain gold may be placed under three heads: auriferous rocks, auriferous veins, and auriferous alluvium.

I. The first group comprises rocks rich in magnesium and with gold scattered through them. A good example of this is the mines of Nijni-Tagil in the Ural, where platinum is also found. As a transition between this division and the next may be cited the auriferous minerals contained in some rocks of an igneous origin, as, for instance, the gold that is to be found in the granite of the west coast of South America and in certain parts of Brazil. Granite containing tin in the Erzgebirgen, in Bohemia, is a similar formation. This division of auriferous grounds, very interesting from a geological, is less so from an economic point of view, for it contributes but very slightly to the production of gold.

II. The next group, the auriferous veins, comprises all the veins that have filled up, by means of hot-springs or geysers, the fissures in ground upheaved and broken. These veins may be subdivided into three categories according to the different natures of the soil in which we find them. (A.) Veins of recent volcanic rocks, principally the prophyllite. Gold is here found mixed with silver, and it is only in this division that those exceptionally rich seams—the bonanzas—are met with. To this category belong the Comstock Lode, in Nevada, which is the most noteworthy example; the auriferous beds of Queensland, some in New Zealand, and those of Schemnitz in the Carpathian range of Hungary. The gold is found sometimes in spangles and as ‘electrum,’ or silver and gold combined, or, again, mixed with copper or sulphur. (B.) Veins in more ancient volcanic rocks, especially diorite. The gold here is not, as in the preceding division, mixed with silver, but, on the other hand, there are no bonanzas. The best example of this category are the veins of Victoria. (C.) Veins in the schists, where they meet with granite, or even in granite itself, even distant from volcanic regions. It is supposed that in this case granite has been the eruptive force which has brought the gold with it. These veins are sometimes very extensive: as, for instance, the famous Mother Lode in California, which spreads itself over a vast region; but experience proves that they are seldom sufficiently productive to repay a miner’s toil. Silver is never found here, and gold only in the same circumstances as in the preceding divisions. Examples of this class are to be found in California, in New Caledonia, in Tasmania, and in the Pennine Alps.

III. Auriferous alluvium. This alluvium is formed by the decomposition of different rocks containing gold, but it has been remarked that recent volcanic regions give much less than other classes of grounds. The veins richest in precious metals are, therefore, not those which produce deposits containing the most. Gold is in this instance generally found as spangles or quite tiny grains, and sometimes as nuggets, of the size of a hen’s or even a turkey’s egg. An extraordinary point is that the gold found in this alluvium is purer than the metal found in the veins from which it comes, though, of course, this must have proceeded from them originally. Neither this phenomenon nor the formation of nuggets has yet been satisfactorily accounted for or explained. The ‘placers’ of California, Australia and Siberia are the most remarkable examples of auriferous alluvium. This latter can also be divided into two categories: (A.) that found on the surface of the earth, on river banks, where gold can be almost picked up, sifted from the soil and washed in the most primitive fashion; and (B.) that of an earlier date, covered over by more recently deposited soil, and which can only be reached by labours which frequently entail large expense.

In California these ancient deposits, named 'deep leads,' are sometimes covered with basalt or lava. They are then generally worked by hydraulic pressure. Water, enclosed in dykes at a higher level, is made to flow in the direction of the works by means of pipes; then branch pipes are put which carry it with great force on to the auriferous deposit, and reduce the whole bed to a state of liquid mud. This runs away in wooden troughs, so arranged that the particles of gold are stopped in their passage.

The 'deep leads' worked at Ballarat, in Australia, are most curious. They are covered by 400 feet of relatively recent soil, amongst which are four layers of lava proceeding from a neighbouring volcano, now extinct. These 'deep leads' are the banks and alluvium beds of ancient watercourses now hidden under successive layers of sediments. The wealth of these deposits is very unequal, and the amount they produce most uncertain.

The capital point in these views concerning the production of gold is that by far the greater amount proceeds from these alluvium beds. In 1854, Whitney estimated that nine-tenths of the gold in the possession of men had this origin. Dr. Suess has made a calculation for the period from 1848 to 1875 with the following result:—

Value of gold in millions of francs derived from	Million francs
I. Veins:—	
Modern volcanic	769
Ancient volcanic	822
Schist and granite	240
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	1,831
II. Alluvium beds	14,973
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Total	16,804

We learn from these figures that of the whole sum of gold produced between the years 1848 and 1875, the working of rocks has produced an average of 12·02, and that of alluvium beds 87·98. During the last few years, as the quantity of gold procured from the placers has rapidly diminished, the gold that the miners' work extracts from veins has taken a more important place. But, in spite of this, according to Dr. Suess, the future production of gold depends almost entirely on the riches of alluvium beds.

The finding and extracting of gold from the earth goes on always in the same way. Some explorers arrive in an unknown region and find on the banks of a river some gold-dust, or may be some nuggets. The good tidings are spread abroad at once, and adventurers from all sides arrive in crowds. The surface sand is very quickly washed and produces a large quantity of gold; but the more active the workers, the sooner is all the superficial gold taken. Individual labour is no longer of avail. Large capitals must be employed to establish necessary apparatus for the working of the 'deep leads,' or for sinking shafts in volcanic or granite rocks. The 'deep leads' are in their

turn worked out, and the working of the veins brings but scant profit, in a general way, if one have not the good fortune to fall on a bonanza, which is rare.

These mines are thus all abandoned, one by one, and fresh regions must be resorted to, to take their place. While the working of silver continues sometimes for centuries in the same region, that of gold cannot be counted upon; it is always of far shorter duration. It follows, therefore, that gold mines are constantly to be found, and, in fact, generally are situated at the extreme limits of civilisation. This curious fact had already been remarked by Herodotus (III. 106). After having spoken of the quantity of gold-dust sent to Darius by the inhabitants of India as tribute, he adds that, for one reason or another, it generally happens that the rarest and most precious things come from the remotest corner of the inhabited globe, and Humboldt has taken this passage of Herodotus as an epigraph to his studies on the variations in the production of gold.

The discovery of fresh countries is often the cause of an influx of the precious metal, and this is in itself frequently an incentive to the colonisation of countries hitherto uninhabited, as we have seen in California, Australia, and Siberia. The old countries have completely ceased producing gold, and it is only in regions as yet unexplored that we can hope to discover fresh veins. A rapid epitome of the history of gold-workings will serve to confirm this law of the continuous exhaustion of auriferous beds.

In ancient times gold was, comparatively speaking, abundant. It proceeded principally from the washings of the rivers of Asia. The sands of Pactolus, the golden fleece conquered by the Argonauts, the gold of Ophir, the fable of King Midas, all contribute to show the Eastern origin of the yellow metal. According to Pliny, Cyrus brought back 34,000 Roman pounds in gold, a sum corresponding to nearly two millions sterling. The treasures Alexander the Great took from Persia amounted to 351,000 talents, or eighty millions sterling. Gold came also from Arabia and, by the Nile, probably from the centre of Africa. One may read too of the rivers of Spain and of the mountains of Dacia. In Abrudbania, in the centre of Transylvania, galleries are to be found that date from the time of the Romans, in rocks that are still being worked at the present time, but producing only insignificant quantities of metal. Roman writers speak of the quantity of gold found in the Tagus and the Douro. Pliny mentions Asturias as the country producing the largest amount of gold. At Idanha Velha, in Portugal, a tablet has been found bearing the following inscription: 'Claudius Rufus returns thanks to Jupiter for his having caused him to find 130 pounds of gold.' *Ti. Claudius Rufus Jovi optimo maximo ob reperta auri pond. CXXX votum libens solvit.*

During the middle ages these sources of riches dried up, and

the attempts made by several English companies to resume the workings were ineffectual. Bohemia, Silesia, Moravia, the Tyrol have all produced gold, and fortunes have formerly been made there. In Gneiss, above Gastein, the retreat of the glaciers has brought to light old workings, and at the present day a little metal is still to be found there. On the Italian side of Monte Rosa, in Val Sesia, and in the Val Anasasca, at Pestarena, auriferous veins are worked, but the production is insignificant. The only workings in Europe at all worth mentioning are those of Schemnitz in Hungary. In fact, our continent may be fairly regarded as exhausted.

After the discovery of America, the Antilles, principally Hispaniola and the western coast of the Gulf of Mexico yielded a great deal of gold. It is from Hispaniola that the gold offered to Alexander VI., and which he employed for the gilding of Santa Maria Maggiore, came, as the following inscription proves: '*Quod primo Catholici reges ex India receperant.*' Very soon these mines ceased to produce. Some curious facts relating to the production of gold during the sixteenth century are to be found in a Dutch book published in 'Amsterdam,' 1590: 'Gold comes,' it says, 'from different countries—from the mountains of Bohemia, from the rivers of Pannonia and Sweden. More than 20,000 pounds weight of gold came from Spain every year, but now these mines are exhausted. Gold arrived afterwards from the east Spanish Indias, from San Domingo; at first, and then from other parts; but all that is now a matter of the past. Actually, gold comes to us from Peru, some time ago for three millions yearly, and now for five, six, and eight millions. But as time goes on these mines will be exhausted and abandoned, as the others have been.' This prediction of the old book, *Tresoir van de Maten ende Gewichten*, which resumes all in Suess's theory, has come to pass, and now no more gold is yielded by these parts of the world.

Humboldt had great hopes for New Granada and Columbia, where precious metal was to be found on all sides, but, in spite of English capital which brought over the most perfected means of working the mines, the gold yielded annually does not amount to more than 500,000*l.* Before the arrival of the *Conquistadores*, the Indians had gathered from the river sands large quantities of gold in Peru, Chili, and along the whole western coast of South America. Later these countries produced a considerable amount of silver, but very little gold; to-day the production is ten or twelve times less than when Humboldt visited them. From 1500 to 1875, the total production of gold in South America, with the sole exception of Brazil, has been 260,000,000*l.* sterling. Nowhere can the typical history of the working of gold mines be so well followed as in Brazil. At the close of the sixteenth century, the inhabitants of the province of S. Paulo, apprised of the presence of gold by the nuggets with which the savages adorned

themselves, commenced washings. In 1697, Bartholomeo Bueno found rich deposits of gold in the province of Minas Geraes. Adventurers quickly reached the spot and war broke out between the Paulists and the Portuguese of the coast. Finally, the governor succeeded in re-establishing peace and order, and the collecting of the precious metal was set on foot on a firm basis, and developed with extraordinary rapidity. Towns were built, and amongst others Villa Rica. After the year 1720, the province of Matto Grasso begins to yield up her treasures. In the eighteenth century the placers of Brazil played a similar part to that of California in the nineteenth. Minas Geraes alone gave, in the middle of this century, about 1,200,000*l.* a year, and Brazil more than 2,000,000*l.* sterling, but the alluvium beds were soon exhausted. The working of the veins was then commenced, but with no profit. Towards the year 1820 the total production of Brazil had fallen to 100,000*l.* Since that date, English capital has paid for the working of many mines, and notably those of Jacotinga and of St. John d'Elrey, but in each case the money has been all or in great part lost. Only the last-named mine yielded recently (in the year 1876) a sum worthy of mention, about 200,000*l.*, but almost without profit. The yieldings of the mine Don Pedro North del Rey are regularly diminishing; here are the figures—1875, 34,992*l.*; 1877, 28,172*l.*; 1879, 4,956*l.* It follows, then, that Brazil, which a hundred years back exceeded in riches all other auriferous countries, became impoverished in fifty years, and may now be considered as exhausted. The total production of gold in Brazil from the end of the sixteenth century till now is estimated to be 140,000,000*l.*

In ancient times, and in the middle ages, Africa was noted as the country of gold. Herodotus speaks of the gold gathered by the Carthaginians from beyond the columns of Hercules. The Arabian geographer El Edrisi (A.D. 1154) speaks of the gold produced by the Wangara country, from where the river Niger rises; and the Moor baptised by Leo X., Leo Africanus, who had scoured the interior of Africa, also speaks of the gold of Wangara and of Timbuctoo. It is thence that the Moors of Spain and of the north of Africa procured the precious metal. Recently the French from Senegal have occupied this gold country, and have in reality found 'deep leads' and veins in diorite, as in Victoria, but the produce is too small to be remunerative. All the famous Gold Coast does not yield 80,000*l.* a year. The golden sand, washed by the negroes, is sufficient to reward them for the labour they bestow during their leisure hours, but not to pay a proper interest to any European undertaking.

The Egyptians obtained large quantities of gold from the Upper Nile and from Ethiopia. An inscription under Thutmes III., 18th dynasty (B.C. 1600), speaks of gold coming from the land of Mayu. Another inscription, of the time of Ramses II., 19th dynasty, tells us that the king, seated on a golden throne, issued orders for the

opening of gold mines in the land of Atika. A papyrus now at Turin contains a detailed account and map of these workings. Mummies are often found with necklets and jewels in massive gold. Gilding was in no ways spared. Herodotus tells us of a king of the Ethiopians attacked, but not defeated, by Cambyses, who loaded his prisoners with golden chains, this metal being commoner than bronze. At Sofala also gold was very plentiful in the middle ages. The geographer Edrisi tells us that copper was worn as an ornament in preference to gold. At Daghouta still more gold was to be found than at Sofala. When, in the year 1867, the German traveller Mauch discovered near Sofala ancient alluvium workings, and even remains of the masonry of shafts and traces of ancient Israelitish worship, it was believed that we had discovered the biblical Ophir, and the more so as in ancient maps Sofala is written Sophir. However that may be, neither on this coast, nor in the Transvaal, nor in the Orange Free State, have any of the attempts at workings which have been made proved a great success. The riches in gold of the African continent is a thing of the past. The marvellous necklace of the Queen Aah-Topeh which is exhibited in the museum of Bulak, and which dates 3,600 years back; the golden chains of the Abyssinian captives in the time of Cambyses; the treasures brought by the Queen of Sheba to the temple of Solomon 2,860 years ago; the masses of gold hanging on to the throne of the King of Ghâna, of which Edrisi speaks, 700 years ago, and which weighed 300,000 mithkal (value 175,000*l.*)—all these memories or legends prove beyond a doubt that in ancient times the 'dark continent' produced a great deal of gold. What it yields to-day is of very little importance, at most 240,000*l.* a year. The total production since 1495 is estimated—we must say, upon very uncertain authorities—at 100,000,000*l.* sterling. The whole of North Africa to the Sahara and the falls of the Nile is formed of a sedimentary soil which has never yielded precious metals, but in the centre of the continent ancient rocks are to be met—granite, gneiss, syenite, hornblende—with quartz veins containing gold, and thus auriferous alluvium has been formed. Only it appears that antiquity and the middle ages have exhausted it all. According to remarks made by M. Jevons, the aborigenes have always been the first to discover and take advantage of auriferous sands. It is certainly possible that in the centre of Africa rich gold veins and even bonanzas may be found, failing rich 'placers,' which must not be counted on, for, did they exist, their produce would already have reached the coast. At all events, when we consider that the workings of rocks have not yielded one-fifth of the total produce in gold, we cannot expect that, in this instance, the continent of Africa will give the lie to the general law. What China and Japan produce is far from sufficing for their own consumption.

The three important centres of production at the present time

are Siberia, the United States, and Australia; but the two latter are already beginning to fall off. Let us first examine Siberia. Here the auriferous alluvium spreads itself over an enormous space, from the Ural to the region of the Amour River. In Siberia the work is less active than in the Australian or Californian placers. It is carried on either by labourers who pay the privileged contractors, or by convicts. The severity of the climate and the frosts make any washings out of the question during the greater part of the year. Accordingly, progress is not so rapid, and exhaustion will not come so soon. The washings are found in the volcanic districts of the Asiatic Ural Mountains and in the syenite, the gneiss and the hornblende, at Jenisei, at Tychovo-Sadomsk on the Nigra, in the valley of Chomolcko, and on the banks of the Muza, in the government of Nertschink; finally, in Upper Amour, and quite recently in a very remote region on the banks of the Nyman and Olga rivers. Here, as in California, gold is nearly always found where granite comes in contact with the schists. In Siberia the washings are slowly falling off, as elsewhere. Those of Jenisei fell from 1,000 puds in 1850, to 300 during the last few years. Only, as the alluvium is to be found more or less everywhere spread about over an immense territory, fresh workings take the place of those that are no longer productive, and the total yield tends rather to increase. In 1869 it amounted to 4,500,000*l.* sterling. In 1876 it had risen to 4,650,000*l.*; in 1877 to 5,700,000*l.*; in 1878 to 5,850,000*l.*; and in 1879 to 5,550,000*l.* sterling. The total contribution of Russia to the gold stock of the world is estimated at 120,000,000*l.* sterling.

It is North America which has produced in the latest years the greatest amount of gold. The rapidity with which the production of this metal has developed itself there is really prodigious. This was due to two causes: first, the natural riches of the country; and, secondly, the extraordinary energy displayed by the Americans in making the best of these riches. The precious metal is to be found in that long double chain of mountains which extends between the coasts of the Atlantic and the plains of the centre. In this great range, which is called the Rocky Mountains, the upheaval of the earth's crust by eruptive rocks have brought near the surface both gold and silver. In British Columbia even, the washings of Cassiar, of Omenica, and of Cariboo, have produced annually about half a million sterling in gold. The States of Idaho, Montana, Oregon, and Washington yielded in the year 1870 about a million sterling. In Montana the annual production has very soon considerably decreased. In 1866 it amounted to \$18,000,000; to-day it is not more than \$2,500,000. From 1864 to 1871 Idaho produced annually from five to seven million dollars; in 1880 the production had fallen to \$510,546. In 1868 Oregon and Washington yielded \$4,000,000; in 1879 they did not reach more than \$1,275,000.

Dakota slightly increased from \$2,000,000 in 1877 to \$2,420,000 in 1879. Colorado sustains an average annual production of about \$3,000,000. California has passed through the three habitual periods of the gold production. After the year 1848 the washings of the river sands produced immense quantities of gold; now, only the Chinese find this sufficient to procure them sustenance. The superficial washings were soon exhausted, and excavation of the 'deep leads' and veins was then proceeded with.

The whole highest ridge of the Sierra Nevada, running parallel with the Atlantic, is granitic, but halfway down the slope of the chain, towards the west, strata of schist and limestone are found amongst the granite. At the point of contact, there extends from north to south of the State a zone, about eight to nine miles in width, which contains all the auriferous veins of this country. This stratum, brought to light by erosion, forms in many places an almost perpendicular wall, overhanging the forests spread out at its feet. The 'Mother Lode' commences in Mariposa, and passes the limit of the State at the north, where it is covered by the lava of the powerful and as yet unextinct volcanoes Pilot Peak and Lassen Peak. This lava has also covered ancient alluvium soil with basaltic streams, from 50 to 200 feet thick, which form the present 'Table Mountains.' This formation is also found more south in the Sierra Nevada, not far from the 'Big Trees.' The alluvium beds, covered by basalt, and resting on the strata of granite and of schist in the chain, contain gold, and it is from there that the lower, superficial, and now exhausted auriferous sands were washed away by the force of mountain streams and torrents. These 'deep leads,' and the veins of the Mother Lode combined, have taken the place of the river 'placers,' and so the Californian production is still from fifteen to seventeen million dollars.

It was in Nevada that the famous Comstock Lode was discovered, which, quite recently, was supposed to be going to inundate the world with a complete overflow of gold. Parallel to the west of the Sierra Nevada runs a chain, the Virginia Range, which is composed of comparatively recent volcanic rocks. These rocks have submerged the lower part of the mountains, and principally Mount Davidson, which rises to a height of 7,827 feet, and which is composed of older syenite. At the point where the more modern volcanic rock, known as propylite, terminates, at an altitude of from 5,800 to 6,000 feet, appear the veins of the Comstock Lode. A crack was formed between the more ancient mountain and the rock covering it. This rent extends for a distance of 22,000 feet. Its width varies a great deal: sometimes it reaches 200 feet, and sometimes it is very much narrowed by the two walls of propylite on the one side and syenite on the other. Broken pieces falling from these walls fill it up in places; the rest is occupied by the auriferous quartz, where the 'rich chimneys,' the bonanzas, are found. The most powerful of these is

the bonanza of Gold Hill, which descends to a depth of 700 feet. Several companies are engaged in the excavation of this marvellous vein. The most favoured has been the *Virginia Consolidated*, which, out of twenty-five million dollars produced by the Comstock in 1875, yield seventeen million. The richness of the vein was ascertained at a depth of 1,600 feet. Shafts have been sunk to 2,500 feet, and one has been commenced which it is hoped will descend to 4,000 feet. A tunnel, the total length of which is to be 20,000 feet, has been bored in the side of the mountain to enable the vein to be worked from underneath, and the water to be carried off without using pumps: but this gigantic undertaking, which is being directed by the engineer Sutro, has, to all appearances, been commenced too late. On the one hand, the vein, contrary to all expectations, is poorer as the workings attain a greater depth; and, on the other hand, the heat at the bottom of the shaft is simply intolerable, viz. 46° Centigrade, and the hot springs that are found there have a still higher temperature, according to the close proximity to the centre fire. The workmen, who work quite naked, are instantaneously in a bath of perspiration; they can scarcely breathe, and are obliged to rest every ten minutes. Under these circumstances the price of labour is of course extremely high, and unless a fresh bonanza be found, the mine will finally be abandoned. The rapid diminution in the amount of production, and the alarming fall in the value of shares, do not allow one to count on a brilliant future. This prodigious vein has exceeded in riches all that had ever been found previously in as great a degree as the placers of California surpassed any ancient washings. In ten years it has produced two hundred million dollars, ninety millions of which were gold. The adventurer who in 1869 discovered this famous hoard of riches, Henry Comstock, after having sold his claim committed suicide. The 'furia Americana' which has been displayed in the working of this mine has contributed to accelerate its exhaustion. The Comstock Lode, which in 1877 yielded \$37,911,000, of which \$17,771,000 were gold, fell off, in 1878, to \$10,404,000 silver and \$9,825,000 gold, total \$20,230,000; in 1879, to \$5,190,000 silver and \$3,639,000 gold, total \$8,830,000; and, in 1880, to \$2,634,000 silver and \$2,678,000 gold, total \$5,312,000. The production of the first quarter of 1881 shows a still greater decrease; the total is only \$426,400 against \$7,549,000 in 1877, and \$1,615,800 in 1880. The aggregate value of the twenty-eight principal mines on the Comstock Lode, which was, in 1875, \$271,059,200, was on the 1st of May 1881 only \$14,030,058. This rapid diminution has affected the total production of gold in the United States, which, according to official estimation, amounted to \$47,266,107 in 1878, \$38,900,000 in 1879, and \$36,000,000 in 1880.

The traveller who visits the American gold country sees every-

where works abandoned, buildings in ruins, and localities, which were but recently flourishing, with scarcely an inhabitant. Many of the mines established in the Mother Lode are no longer worked. Fortunately new ones are discovered, but they will be exhausted in their turn.

The director of the Mint of the United States, M. Burchard, thinks that the number of mines worked exceeds a thousand, but many of them leave the workers at a loss. It is in the north of the Rocky Mountains that one still hopes to make happy discoveries. It is estimated that North America has contributed 14,000,000*l.* sterling of the stock of gold of the world.

The production of gold in Australia has followed pretty much the same course as in California. There, also, they have passed from the river sands to the deep alluvium, to arrive at last at the direct working of the veins; but from that moment the produce has gradually diminished. The chain of mountains which extends in Australia from north to south, parallel to the east coast, is formed of sedimentary strata, interspersed in many places with volcanic and eruptive rocks. Numerous veins, 'quartz reefs,' are visible, and contain gold. It is of their fragments that the auriferous alluvions are formed, which one meets with on all sides. These alluvions are easily worked, and yielded to the province of Victoria, as soon as they were discovered, a quantity of precious metal. After Campbell in 1850, and Hargreaves in 1851, had found the first nuggets, there was a rush to the gold-fields. In 1852 the production had already risen to 1,974,975 ounces. In 1855 it attained to 2,497,723 ounces; in 1856 it reached its maximum with 2,985,991 ounces, of a value of about 12,000,000*l.* sterling. Since then, although gold has been found in New South Wales, Queensland, Tasmania, and New Zealand, the supply has continually decreased. For Victoria the yield was, in 1876, 1,095,787 ounces, of which 605,859 came from the veins, and 357,901 from the alluvions, and, in 1879, only 758,947 ounces, of which 465,637 from the veins, and 293,310 from the alluvium. The number of miners has also considerably diminished. In 1850 there were 147,358, of whom 33,673 were Chinese. In 1873 there were not more than 37,453, of whom 14,784 worked at the veins, and 22,769 at the alluvions.

In the province of New South Wales the mountains contain veins and the rivers auriferous sands. They were worked in all directions in a zone of at least 180 miles breadth; but the veins were not remunerative, and the alluvions were soon exhausted, so that the product regularly lessened. In 1871 it rose, according to Daintree, to 535,492 ounces.¹ For the later years I borrow the figures from the excellent report of the German Consul at Sydney, reproduced by M. Soetbeer.²

It says: 'The gold received at Sydney, at the Mint of the Colony,

¹ Queensland; 1873.

² *Jahrbücher für national Ökonomie*, 1881, 4 Heft, p. 370.

from New South Wales, in 1876 rose to 126,780 ounces, of the value of 479,133*l*. These figures diminish each year. In 1872, the year which yielded the most, the produce was 1,513,186*l*. In 1878, as I have remarked in my report of last year, the production of gold continued to decrease. In 1877 the Mint only received 97,582 ounces, of the value of 366,329*l*. In 1879 the gold receipts (as proceeding from the workings of New South Wales) have fallen to 75,492 ounces, of the value of 279,166*l*. The yield of gold from all sources amounts to 109,347 ounces, of the value of 382,741*l*. Three-fourths of the ore are obtained from the washings.'

The chain of Australian mountains, on entering Queensland, widens, and with its lateral ridges attains a breadth of twenty-five miles. Here also recent volcanic rocks, diorite and even granite, have brought gold to the surface. In many of the rivers, auriferous sands and large nuggets have been discovered, and already the veins are heavily worked. The richest mine, the 'Comstock' Lode, of that Colony is that of Gympie, to the north of Brisbane, on the Mary river. At the end of 1868 this mine yielded nearly 84,000 ounces, and 70,852 ounces in 1869. Since then the produce has been maintained tolerably regularly. The works have already reached a depth of 600 feet.

Queensland also has had its period of promising discoveries. Thus in 1874, the Palmers gold fields, where 6,000 men were collected, produced 175,000 ounces. The German Consul of Brisbane gave the following figures for this province: 1,429,929*l*. in 1876, and 1,611,105*l*. in 1879. He added, 'As fresh discoveries continue to be daily made, and as this district contains hundreds of square miles where no white man has yet planted his foot, still further discoveries of rich goldfields may be hoped for.' This hope, although not without foundation, is not yet realised, as from the most recent reports the exportation of ore from Queensland had fallen to about one million sterling in 1878. South Australia and Tasmania have also produced a little gold, the total value being about 40,000*l*. in 1878.

New Zealand yielded about forty millions sterling of precious metal between 1857 and 1879. The northern island has not contributed more than five millions, found principally in the veins of the peninsula of Coromandel which have not formed auriferous alluvions. In the southern island, on the contrary, which has produced seven times more (or thirty-five millions), the gold was found almost exclusively in auriferous sand and deep leads, which, strange to say, were discovered on the declivity of the mountains; here they also employed, as in California, hydraulic power for the working, and the process of exhaustion resembles that of the other gold countries.

The growth is rapid, and the decline equally speedy; thus a gold field near Otago gives, in 1861, 187,695 ounces; in 1863, 580,233 ounces, and falls in 1869 to 149,364 ounces. The production of the two isles diminished, though slowly, of late years. The value of the

gold exported was in 1874, 1,500,000*l.*; in 1875, 1,400,000*l.*; in 1876, 1,268,599*l.*; in 1877, 1,476,312*l.*; and in 1878, 1,244,192*l.*

The following table, prepared from the very careful calculations of M. Soetbeer, shows the progressive decline of the total production of gold in Australia, which has fallen to the half of what it was twenty years ago.

	Yearly average	
	Kilogrammes	Value : German marks
1856-60	86,700	241,893,000
1861-65	77,700	216,783,000
1866-70	70,400	196,416,000
1871-75	59,900	167,121,000
1876	59,100	164,889,000
1877	52,300	145,917,000
1878	45,300	126,387,000
1879	39,000	108,810,000

The exportations of metal to England have diminished still more rapidly and more abruptly. This seems to prove that Australia absorbs the metal, partly for her home circulation, and partly for her direct commerce with the Indies, China, and Japan. From 1871 to 1875 England received from Australia an average each year of 7,097,800*l.* of gold; in 1878, 5,680,000*l.*; in 1879 only 3,180,600*l.*; and in 1880, 3,614,200*l.* These are the actual facts, and they are not reassuring for the future. Certain mineralogists, as, for example, G. Ulrich of Dunedin in New Zealand, Director of the Mining Department of Sydney, do not share the gloomy forebodings of Dr. Suess. After all, they say, if the production of gold diminishes in Australia, it is not for lack of metal, but because the workmen prefer to buy the land for agricultural purposes, or for the rearing of cattle. So it is, but that is precisely what Dr. Suess affirms. When the gold-fields are exhausted, it is necessary to excavate the veins, and then the work generally ceases to be remunerative, though some continue to work for a time, encouraged by the exceptional success of some miners. Hope and the gambling fever stimulate them to work at a loss, but at length they become discouraged and stop. According to M. Del Mar, on an average, each dollar drawn from the earth costs two.

Australia still supports herself by the goldfields and the deep leads; but when the miner shall be reduced to the 'quartz reefs,' the produce will certainly be reduced to one half. M. Ulrich himself, notwithstanding his sanguine views, admits that Victoria will fall to 600,000 ounces—that is, to half of what she has recently produced. It is estimated that Australia has supplied 260,000,000*l.* sterling in gold to the world.

The reader will, no doubt, have been fatigued with the uniformity of these details, but it is in *that* that the instruction consists. It is this identical repetition of the same facts which enables Dr. Suess to predict that the production of gold is fatally destined to decrease.

He admits that one may perhaps still discover, in the less explored regions of the Rocky Mountains of Central Africa, or in Australia, goldfields as rich as those of California, or veins as marvellous as the Comstock Lode; but the more powerful our present process of working, the more rapid the exhaustion of the new mines. It has been so in the past, and it will not be otherwise in the future.

From all these facts Dr. Suess concludes that the desire to make everywhere gold the *only* coinage, to the exclusion of silver, is pure madness. Geology opposes it. There does not exist in the world gold enough for that purpose. The true money metal is silver. Locke was right in saying 'Silver is the instrument and measure of commerce in all the civilised and trading parts of the world;' and Bagehot expressed the same opinion before the Silver Commission of 1876 (Question 1,389): 'Silver is the normal currency of the world.' In proportion as the people become wealthy and industrious, they require more and more gold, so that the diminishing production of gold will be barely sufficient for the use of the arts and manufactures, and the yellow metal will disappear, little by little, from circulation. At all times gold has been a subsidiary money—a money of luxury. It was a consequence of natural laws. Economical necessities will oblige men to submit to them. That which has passed since the date of the publication of Dr. Suess' book (1877) has plainly confirmed his predictions. Already the scarcity of gold has created an appearance of disquietude. One cannot be surprised at it, when one thinks of the small quantity of gold which is at man's disposal.

The total quantity of this metal produced since the discovery of America is calculated to be 1,400,000,000*l.* A learned professor of the University of Rome, Messedaglia (*Storia e Statistica dei Metalli preziosi*), has calculated that this sum, equivalent to 535 cubic mètres, would be sufficient only to cover the pavement under the cupola of the Pantheon or of St. Paul's with a bed of gold of 37 centimètres, or one foot in depth, and the annual production would add to it barely one centimètre. Of this quantity what remains under the form of money and ornaments? Perhaps one milliard sterling. M. Soetbeer shows that there exists as money in civilised countries (less India and the extreme East) 13,400,000,000 German marks (670,000,000*l.*) of gold, and 8,400,000,000 marks (420,000,000*l.*) of silver. That which singularly aggravates the economical situation is that the world's currency, which was maintained yearly, till 1873, by gold and by silver united—that is to say, by a total value of 35,000,000*l.* sterling—is now to be kept up by gold alone, of which the production does not attain more than 20,000,000*l.* each year. Trade consumes certainly from twelve to fourteen millions sterling; for official reports show that manufactures and arts require, in the United States, 10,000,000 dollars or two millions sterling, the same amount in

France (54,000,000 francs in 1878), and even more in England: that is, six or seven millions for these three countries alone. India takes away every year between two and three millions, so what remains for the requirement of the coinage in all the civilised nations? We must not forget that, according to M. Soetbeer's calculations, there has been coined in the last twenty-five years, from 1851 to 1875, 800,000,000*l.* sterling gold, and 440,000,000*l.* silver. Deduct what you will for re-coinage, there remains certainly, taken yearly by the mint, a sum immensely superior to the four or five millions gold that the arts leave for the monetary requirements.

Even supposing that the absorption of gold by America will suddenly stop—and it amounted in 1879–1880 to \$75,891,391, and in 1880–1881 to \$91,168,650, or for these two years nearly 34 millions sterling, that is the third of all the gold coin of England—it is beyond all doubt that if silver remains proscribed, there will not be gold enough for the monetary and industrial uses of Europe. Already, at the very moment these lines are written, the gold scarcity begins to be seriously felt on the money market. The Stock Exchange is looking with anxiety to every withdrawal of metal from the Bank. What the late Mr. Bagehot used to call 'Apprehension Point' is very near. Soon the sentiment of living under the perpetual fear of lacking the breathing air of commerce—*i.e.* of the means of exchange—will become intolerable, long before the exhaustion of the gold washings predicted by Dr. Suess will be realised.

It becomes every day more evident that the dream of using gold alone as universal money is a mere impossibility. The two precious metals, gold and silver, are not even sufficient for the rapidly growing wants of trade and luxury throughout the world.

EMILE DE LAVELEYE.