

## THE FUTURE OF GOLD.

BY THE HON. ROBERT E. PRESTON, DIRECTOR OF THE MINT.

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THE history of the production of gold may be divided into four periods : the first ending with the discoveries of Columbus, the second with those of the Californian and Australian goldfields in 1848 and 1851, or say 1850 ; the third in 1885 ; the fourth begins in 1886, with the discovery of the Witwatersrandt gold mines.

The year in which these mines were discovered is chosen as the beginning of the last period, and not 1887, in which the Transvaal began to figure to some small extent in the list of gold-producing countries, for their discovery is of far greater importance to the world than the few thousand ounces of gold which they added to the supply of that metal in the latter year.

It cannot be disputed that the discovery of the Witwatersrandt mines marks an epoch in the history of the production of gold, and is entitled to a place side by side with the discovery of the mines of California and Australia, which has always been considered by statisticians a point of demarcation between two periods in the history of the production of the precious metals.

On the first two of the periods into which the history of the production of gold has been divided above it is not necessary to dwell here. The third might also be passed over in silence, were it not necessary to compare it with the fourth, in order to form an intelligent opinion on the relative magnitude of the output of gold in recent years, on its prospective production in years to come, and to bring out into strong relief the fact that never before in the life of mankind has the yearly supply of that metal been as great as now. To effect this purpose, it is necessary to go back a few decades before the beginning of the third period.

The average yearly production of gold during the ten years 1831-1840 was only 20,289 kilograms, or 652,291 fine ounces; during the ten years 1841-1850 it rose to an annual average of 54,759 kilograms, or 1,760,502 ounces. This was just prior, it will be noticed, to the beginning of the third period into which I have divided the history of the production of gold. Now mark the increase! During the five years 1851-1855, in consequence of the rich harvest from the recently discovered mines of California and Australia, the average annual production of gold suddenly leaped to 199,388 kilograms, or 6,410,324 ounces, and in 1856-60 to the highest figure that had ever been reached up to that time, and which has never been exceeded since, except in 1892, 1893, and 1894, namely, to 201,750 kilograms, or 6,486,262 ounces; that is, in between twenty and twenty-five years, the annual average of the production of gold increased nearly ten-fold! Even the production of silver during the last quarter of a century has not increased at that rate—1,000 per cent.!

After 1860 the average steadily declined, except during the five years 1866-1870, until in 1881-1885 it fell to 149,137 kilograms, or 4,794,755 ounces.

Thus the decrease in the annual average production of gold after 1860 had been continuous for almost a quarter of a century, and there were not wanting prophets of evil, among them men of world-wide renown in science, like the eminent Austrian geologist, Dr. Suess, who prophesied that the decline would be permanent. Suess's book, *The Future of Gold*, published in 1877, created a sensation in the politico-economic world, although the point from which he viewed his subject was strictly that of a geologist and not of an economist. His celebrated theory is contained in the fourth and fourteenth chapters of his book. Briefly stated, it is this. The earth was myriads of ages ago in a molten or fluid state. When in that condition the heavier elements of which it is composed sank, in obedience to the law of gravitation, deepest, and now lie nearest to the earth's centre. But the precious metals are among the heaviest of all materials—gold, with a specific gravity of 19.253, ranking third, immediately after iridium and platinum. Much lower in specific gravity are silver (10.74), copper (8.09), iron (7.54), etc., but all with a much higher specific gravity than the earth as a whole. Gold is therefore one of the metals furthest removed from the earth's

surface and most inaccessible to man, "because, at a comparatively small distance from it, the increasing temperature reaches so high a degree that mining there finds its limit."

After an exhaustive review of all the gold-fields of the world, and of their condition at the time he wrote, Suess reached the following conclusions :

1. That the production of gold in the future would have to depend mainly on the output from alluvial deposits.

2. That geographical discovery and the new or increased production of gold went hand in hand.

3. That much more than one-half of the quantity of gold obtainable by the means hitherto employed had already passed through the hands of man.

4. That the exhaustion of the alluvial gold deposits and the decline of the production of gold to a small fraction of what it had hitherto been, were facts that could already be foreseen.

5. That the time would certainly come, and probably after a few centuries, when the production of gold would cease to an extraordinary extent; and that metal, on account of its ever-increasing scarcity, cease to be able to maintain the economic position it had hitherto held.

6. That the manner of the occurrence of gold in nature was, therefore, unfavorable to the general adoption of the gold standard, and that such a plan, in the light of past experience of the production of gold, could not be approved.

7. That it had been proven that vein-mining, as a rule, showed a decrease in gold contents with the depth.

What of Suess's conclusions ? Scarcely one of them has been verified by the experience of the last seventeen years. Production now depends much more on vein-mining than on gold-washings. Fully 60 per cent. of the world's production of gold is obtained from the solid rock. There has been increased production independent of geographical discovery by improved technic processes, especially by the cyanide process. Gold production is not declining, but advancing; and in South Africa it has been demonstrated that the gold contents increase with the depth.

If Suess's book had been published in 1857, instead of 20 years later, the world would have ridiculed his theory, notwithstanding the learning, ability, and acumen of its author. But it appeared at a time when the production of gold had been, and

still was, on the decline, and when men's minds were prepared to believe that the decline would be permanent and irretrievable.

That it has not been so is amply demonstrated by the yield of gold during the fourth period of the history of its production, as will be seen from the figures given below, in which the output of the yellow metal in 1886-1893 is given in fine kilograms and fine ounces.

Years.	Kilograms.	Ounces.
1886.....	159,494	5,127,750
1887.....	159,155	5,116,865
1888.....	165,809	5,330,780
1889.....	185,809	5,973,780
1890.....	178,828	5,749,320
1891.....	196,584	6,320,195
1892.....	220,129	7,077,165
1893.....	234,006	7,523,377

The first rude shock which Suess's theory received was the discovery of the Witwatersrandt gold-field, in the South African Republic, which marks the beginning of the fourth and last period into which the production of gold has been divided by the writer. Here was something new which had not been dreamt of in Suess's philosophy.

The mines of the Witwatersrandt did not share at all in the world's gold output of 1886. In 1887 they shared in it only to the extent of 23,125 ounces. Since then their production has been phenomenal. It has been as follows :

Years.	Crude ounces.
1887.....	23,125
1888.....	208,121
1889.....	381,758
1890.....	494,869
1891.....	729,238
1892.....	1,210,868
1893.....	1,478,473

The increase in recent years in the world's production of gold is due most largely to these South African mines. Will that increase continue, and how long? The answer to this question involves a consideration of the prospects of production in South Africa. I remarked above that here was something Professor Suess had not dreamt of in his philosophy. The Witwatersrandt mines had not been discovered when he wrote his book. Not only that, but the occurrence of gold under the geological conditions in which it is found in the Witwatersrandt had been con-

sidered impossible until it was actually obtained there. Geologists were acquainted in 1877 with only two forms of the existence of gold in nature: in veins and as alluvial deposits. In the Witwatersrandt it is found in sedimentary rocks—in strata the component parts of which are pieces of quartz held together by a clayey cement.\*

The Witwatersrandt produces by far the greater part of the total gold output of South Africa—indeed of all Africa.

In 1893 the German government sent a mining expert, Herr Schmeisser, to investigate and report upon the gold mines of the Transvaal. In his report he expresses the opinion that a calculation of the total amount of gold in the Witwatersrandt is impossible, and that in making an estimate of it it is necessary for the present to limit one's investigation to a well-defined and adequately explored tract of the district, and endeavor to establish the lowest figures for that section. For that purpose he chose the part of the gold-field lying between the eastern limit of what is known as the Langlaagte B gold mine and the western limit of the Glencairn mine, which has a profitable working length, he stated, of about eleven and a half miles. It is not necessary, nor have I space, to give here the data he employed. It is sufficient to say that he calculated that from this tract 62,548,000 ounces of gold could be obtained. As, however, nearly two-thirds of the total yield of the Witwatersrandt, from 1888 to January 1st, 1894, had come from mines in that tract, the above figures had to be reduced to 59,572,149.6 ounces, of the value of \$1,020,828,355, which still remained to be mined. At the average rate of increase of the gold product of the Witwatersrandt he estimated that the exhaustion of the lodes on this tract would occur about the year 1919. This calculation was made on the assumption that a depth of 800 metres, or 2,625 feet, had been reached. If mining could be carried on at a depth of 1,200 metres, or 3,937 feet, the supply of gold from this tract, he calculated, would aggregate 99,821,892 ounces, of the value of \$1,710,560,000, and that at the same rate of increase it would require forty years to mine that quantity. Mr. Hamilton Smith, a distinguished American mining engineer, in 1892 estimated the amount of gold in this same tract to a depth of 3,000 feet at

\* A somewhat similar formation of very limited extent had, it is said, been previously discovered in France.

\$1,044,900,000. Herr Schmeisser ascribes the larger results reached by himself partly to a slight difference in the length of tract investigated and partly to the fact that a deep boring made in 1893 in one of its mines warranted him to assume a less rapid dip of the lodes at lower depths. It must be remembered that while the tract under consideration above has a length of only about  $11\frac{1}{2}$  miles the Witwatersrandt has a length of 50 miles.

It would be an easy matter to cite a host of experts whose evidence is corroborative of that just quoted. Indeed all competent judges agree that the gold output of the Witwatersrandt mines is assured for a considerable period of time. The pyrites occurring at a certain depth, which could not be treated by amalgamation, have yielded up their gold contents to chlorination; and it has become possible, by the introduction of the cyanide process, to obtain almost the last traces of gold from the "tailings," which had hitherto been considered worthless. At present only 5 per cent. of the gold is lost. In 1892, 211,866 ounces were obtained from tailings by the cyanide process, while, lately, the amount of gold obtained by this method has been, it is claimed, more than one-third of the Witwatersrandt's total output, amounting, as it did, in September, 1894, to 62,000 ounces out of a total of 175,000 ounces.

In the United States the production of gold had been very uniform since 1887, never varying much from 1,596,375 fine ounces, or \$33,000,000, until 1893, when it amounted to 1,739,323 ounces, or nearly \$36,000,000. It is noteworthy also that the gold output of this country in 1893 was the largest since 1880 and came within 1,677 ounces, or about \$45,000, of equalling the yield of that year.

The net increase of the gold output of the United States in 1893 over that of 1892 was \$2,940,000. The increase was most noteworthy in Colorado (\$2,227,000) and Montana (\$684,613). On the other hand, the product of Nevada decreased \$613,000, out of a total decrease in six States of \$928,785.

It is too early yet to state positively what the gold product of the United States was in 1894, but this much is certain: that it will largely exceed that of 1893 and probably reach \$43,000,000, an increase of \$7,000,000 over that of the latter year.

The tendency of all the gold-producing States is to add to their annual product. The repeal of the purchasing clause of the

act of July 14, 1890, has stimulated the search for gold, and a good share of the increased gold output of the country in 1894 will be traceable to it.

There are no indications whatever of a falling-off in the future of the productiveness of the gold mines of this country, although, considering the rapid growth of the South African production of gold, it is difficult to predict how long the United States will maintain its supremacy as a gold producer. New mines will, of course, be discovered here, but the discovery of such mines is still more likely in Africa. Much will depend on their relative richness. So far as can now be seen, the greatest hope of a largely increased gold product of the United States in the future lies in the removal of all restrictions on hydraulic mining in California. That has already been done to some extent by the so-called Caminetti Act, passed March 3, 1893. If means could be found to remove all restrictions on this class of mining—and that may be a possible achievement—it has been estimated that the deposits in that State would add something like \$500,000,000 to the gold stock of the world.

In Australasia, the production of gold in 1893 was 53,698 kilograms, representing \$35,688,620, against 51,398 kilograms, representing \$34,158,966, in 1892, an increase in the former year of 2,300 kilograms. In like manner 1892 showed an increase of 4,152 kilograms over 1891. Indeed, ever since 1886 it may be said that the gold output of the Australasian colonies has been continuous. The falling off of the yield in 1890 and 1891 from that in 1889 can scarcely be said to have broken the continuity referred to, for both 1892 and 1893 show a marked increase over 1889.

The product from alluvial deposits is continually decreasing in Australia, and that from quartz mining increasing. The alluvial deposits yield only about one-third of the total product of Victoria and not five per cent. of that of Queensland. On the other hand, "the deep leads," which are only deep alluvial beds, but which must be worked like veins, are far from being exhausted. Thus far they have been operated only to a very limited extent. Moreover, a large number of quartz mines have heretofore been abandoned as soon as the pyrites was reached. There is no reason why work on such mines should not be resumed, with the aid of the newly discovered processes which



have proved so successful in South Africa, and with equally successful results. Everything considered, it is to be expected that the production of Australasia will continue to increase at about the present rate at least for an indefinite period. There is even a possibility that it may increase largely after some years, and the realization of that possibility depends on how the newly discovered Coolgardie gold-field in western Australia turns out. By comparing the gold product of all the colonies of Australasia in 1893 with that of 1892, it will be found that there was an increase in 1893 of 80,432 unrefined ounces. More than 63 per cent. of this increase came from the recently discovered western Australian goldfield of Coolgardie. This field may hold a large reserve of the yellow metal and play a very important part in the future of gold.

Russia next claims our attention. Here, too, where the gold yield is almost exclusively from alluvial deposits, the production of that metal has been continuously increasing since 1886, as witness the following figures: 1886, 30,872 kilograms; 1887, 30,232 kilograms; 1888, 32,052 kilograms; 1889, 35,970 kilograms; 1890, 35,296 kilograms; 1891, 36,356 kilograms; 1892, 37,325 kilograms; 1893, 39,804 kilograms. The continuity of the progression is broken only in a single year. It is impossible, however, to venture any prediction as to Russia's output of gold in the future. The circumstances on which it depends are too many—legislation, the price of bread, the seasons, and the course of the paper rouble. Reasoning from analogy, however, one would be inclined to believe that the production of gold in the great empire of eastern Europe would continue to increase for years to come.

Again, there is India. Outside of the great producing countries—the United States, Australasia, Russia, and South Africa—the increase in the production of gold has nowhere been more rapid: 1886, 20,383 fine ounces; 1887, 15,464; 1888, 32,729; 1889, 72,691; 1890, 96,739; 1891, 120,691; 1892, 160,525; 1893, 184,477.

The remaining countries to which I shall direct the attention of the reader during the years of the last period of the history of the production of gold are the three Guianas. Their gold yield was as follows: 1887, 1,802 kilograms; 1888, 937; 1889, 2,348; 1890, 3,186; 1891, 5,026; 1892, 6,185; 1893, 6,439.



The little table which I here append will enable the reader to take in at a glance what the countries named in it have done towards preventing a scarcity of gold, and hindering its appreciation during the fourth period in the history of the production of that metal.

Countries.	1886.	1887.	1888.	1889.
United States.....	\$35,000,000	\$33,000,000	\$33,175,000	\$32,800,000
Australasia.....	26,425,000	27,327,600	28,560,660	33,086,700
Russia.....	20,518,000	20,092,000	21,302,000	23,905,600
Africa.....	1,438,000	1,919,600	4,500,000	8,586,600
India.....	421,600	320,000	676,563	1,502,600
The Guianas.....	.....	718,902	623,070	1,560,300
Total .....	\$83,802,600	\$83,378,102	\$88,837,293	\$101,441,800

  

Countries.	1890.	1891.	1892.	1893.
United States....	\$32,845,000	\$33,175,000	\$33,000,000	\$35,955,000
Australasia.....	29,808,000	31,399,000	34,159,000	35,688,600
Russia.....	23,458,000	24,162,500	24,806,200	26,454,400
Africa.....	9,887,000	15,742,400	24,232,000	29,305,800
India.....	2,000,000	2,495,000	3,318,300	3,813,600
The Guianas .....	2,117,200	3,340,200	4,110,900	4,279,400
Total .....	\$100,115,200	\$110,314,100	\$123,626,400	\$135,496,800

The production of the world in 1886 was 159,494 kilograms ; in 1893 it was 234,006 kilograms ; but, great as was the world's gold output of that year—greater than that of any other year in the world's history—I believe that that of 1894, and of a series of years to come, will be successively and progressively greater, and that what was said by the writer of the world's gold product in 1893 in the Report on the Production of Gold and Silver in that year, will, with the change of a few figures, be true of that series. He there uses these words: "The world's output of gold in 1893 was the largest in history, amounting, as it did, to 234,006 kilograms, of the value in round numbers of \$155,522,000.

"The highest previous yield of gold was in the period 1856–60, when the production reached an average weight per annum of 201,750 kilograms fine, and an average yearly value of \$133,970,000. The output of gold, therefore, in 1893 was 16.08 per cent. greater than the annual average of the period of the greatest productiveness of the Californian and Australian gold mines.

"A still more noticeable fact is that the value of the gold product of the world in 1893 was only 8.77 per cent. less than the

average aggregate value of the gold and silver product of the world in 1861-1865."

The fact is that the production of gold was never so rapid as it is to-day. When the yield of the Californian and Australian gold mines was at its highest, 1856-60, Michel Chevalier and other economists began to inquire what measures governments should take to prevent the depreciation of the yellow metal, and some even proposed its demonetization. Yet now when the production of even 1856-60 is exceeded, and when the value of the annual product of gold alone is almost equal to that of the product of both precious metals before the depreciation of silver began, all the economic evils from which the commercial, agricultural, and industrial world is suffering are ascribed to the scarcity of gold! What better refutation can there be of such a fallacy than the figures adduced in the foregoing pages? They are more convincing than words; for if there is a scarcity of gold now, when was there plenty of it?

R. E. PRESTON.

## WHAT PAUL BOURGET THINKS OF US.

BY MARK TWAIN.

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HE reports the American joke correctly. In Boston they ask, How much does he know? in New York, How much is he worth? in Philadelphia, Who were his parents? And when an alien observer turns his telescope upon us—advertisedly in our own special interest—a natural apprehension moves us to ask, What is the diameter of his reflector?

I take a great interest in M. Bourget's chapters, for I know by the newspapers that there are several Americans who are expecting to get a whole education out of them; several who foresaw, and also foretold, that our long night was over, and a light almost divine about to break upon the land.

*"His utterances concerning us are bound to be weighty and well timed."*

*"He gives us an object-lesson which should be thoughtfully and profitably studied."*

These well-considered and important verdicts were of a nature to restore public confidence, which had been disquieted by questionings as to whether so young a teacher would be qualified to take so large a class as 70,000,000, distributed over so extensive a schoolhouse as America, and pull it through without assistance.

I was even disquieted myself, although I am of a cold, calm temperament and not easily disturbed. I feared for my country. And I was not wholly tranquilized by the verdicts rendered as above. It seemed to me that there was still room for doubt. In fact, in looking the ground over I became more disturbed than I was before. Many worrying questions came up in my mind. Two were prominent. Where had the teacher gotten his equipment? What was his method?

He had gotten his equipment in France.