THE

INDIAN GOLD-MINING INDUSTRY,

ITS PRESENT CONDITION AND ITS FUTURE PROSPECTS.

BY

D. E. W. LEIGHTON,

AUTHOR OF "A HAND-BOOK OF THE INDIAN GOLD-MINING COMPANIES."

MADRAS: HIGGINBOTHAM AND CO.

By Appointment in India to H. R. H. the Prince of Wales, and to the Madras University.

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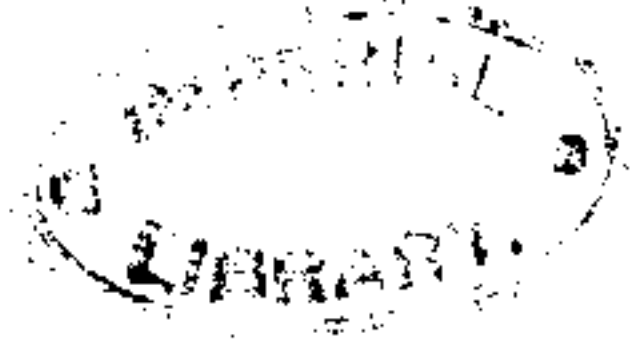

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It is now about three years ago since there was considerable excitement amongst the financial agents, share brokers, and company promoters in London, over what was termed the "re-discovery of Gold in India." These gentlemen were rejoiced at the confirmation of the truth of Bible history; they were also elated at the opportunity afforded them of drawing fresh capital into the market, and of creating new stocks, whereby to extend their transactions, and increase their profits.

To appreciate the situation properly, it will be necessary to take a glance at the history of the money market during the few preceding years. The collapse in the credit of several Foreign States in 1875, and the disclosures before the select committee on foreign loans, had had the effect of making investors suspicious of that class of securities, but British funds could still be purchased at a price that allowed a moderate return on the capital invested in them, and the demand for money from the colonies continued attractive. In 1876 the dread of an European war made people still more afraid of foreign investments, but the colonies were again extensive borrowers, and in spite of an extraordinary abundance of money, it was found impossible to obtain capital in any quantity for joint-stock enterprises. In 1877 there was a renewal of confidence in one or two of the leading Foreign States, and a continued trust in the loans issued by India, and the Australian colonies;

home railways and city corporations were also able to borrow what they required without difficulty; but the Russo-Turkish war, and the depression in trade, had curtailed the profits on commercial, manufacturing, and mining undertakings so much, that scarcely any new capital was drawn towards these. In the following year the total of new issues showed a large increase, but foreign and colonial loans were principally in favour, and new companies were again exceptionally few. The temporary impetus given to speculation by the success of the Berlin Congress in July, was abruptly put a stop to by the downfall of the City of Glasgow Bank in October, which was followed by a decline in the values of all home investments, excepting consols. The increased demands for the latter description of security (more especially by trustees) sent up the price in 1879 to a higher level than it had reached for a quarter of a century; other investments remained out of favour for some time. But in the autumn, trade, which had been almost continuously depressed since 1873, recovered in a remarkable manner; grains first, and manufactured goods afterwards, rapidly advanced in value, and all descriptions of securities participated in the improvement. It was then that the low rate of return on British stocks, and the paucity of foreign loans, contributed to make miscellaneous enterprises more attractive, and the year 1880 witnessed an increase in the number of joint-stock undertakings, extraordinary alike for the objects for which they were formed, and for the ease with which the capital was obtained for them.

This was the opportunity that was seized upon for bringing the Indian Gold Mines before the public at home, and while other enterprises, such as meat importation companies, land mortgage companies, tramways, date-coffee, and electric light companies, all received some attention, the schemes for opening up auriferous reefs in the Wynaad and Kolar proved surpassingly attractive, and secured the largest share by far of the public money.

The mania commenced in December 1879, when one Company with a capital of £100,000 was launched on the market. In

January 1880, another was issued with a capital of £100,000, and in February a third with a capital of £140,000. In March one venture of £100,000 capital was put forward, and in April two with an aggregate capital of £280,000. During May no new Company saw the light, but in June the game began afresh, and one of £200,000 capital was brought out; in July one of £135,000; in August two aggregating £225,000; in September one of £80,000; and in October no less than four with a total of £500,000. In November five Companies with an aggregate capital of £630,000 were issued; and in December one more of £75,000. But confidence in the source from which King Solomon obtained his wealth was by no means exhausted, and for the first six months of 1881 money was still readily forthcoming. In January three Companies with a total of £360,000 were started; in February two with £310,000; and in March four with £550,000. In April one only of £100,000 capital; in May three aggregating £400,000; and in June seven aggregating one million sterling.

It will thus be seen that within the short space of nineteen months forty-one Companies for searching for Gold in Southern India, having a combined capital of over five millions sterling, were brought forward. What is more surprising is that thirty-three of them met, in the opinion of Directors at least, with sufficient encouragement to proceed to allotment, and thus the sum obtained in England for investment in the industry, amounted nominally to £4,050,000.

During the same period, six enterprises of a similar nature were taken up in India, their combined capital being Rs. 2,610,000; and in addition to these, two Companies had been floated some time previously, of which the aggregate capital amounted to £160,000; so that at the end of June 1881 the nominal amount of money devoted to the development of gold-mining in the Wynaad and Kolar was £4,400,000.

It must not be supposed however that the spirit of speculation was confined to these fields. With the revival of trade already referred to, there arose an eager haste to embark in mining adventure in all parts of the world. This is shown by

the following comparison of the number of companies registered, and the total of their capital :—

1877	96	Companies	Capital	£5,167,460
1878	93	do.	do.	5,223,000
1879	83	do.	do.	3,576,200
1880	157	do.	do.	11,940,270
1881	217	do.	do.	20,848,450

Of the 374 Companies brought out during the last two years on this list, 191 were searching for minerals in other countries than the United Kingdom; of these 191 Companies, there were 92 devoted to mining for gold; and of these 92 Companies, 44 were for carrying on explorations in Southern India.

Sufficient reason for increased activity in the search for the most precious of the metals is found in the fact that a scarcity of it had begun to be felt. The first cause of that scarcity was the adoption by Germany at the close of the Franco-German war of the single gold standard, and the very large amount she had coined in the meantime; the second was the resumption of specie payments by the United States. The absorption of gold for the latter country commenced in 1879, and has been very large indeed ever since, as besides what it imports from Europe, it has retained the whole production of its own mines. A third cause has been the creation of new currencies by Italy, and other of the minor European States. These new demands, added to a proportionate increase in the wear and tear of coinage, no doubt contributed to stimulate men's efforts to discover new sources of supply, and that some fifty or sixty ventures should be made in the course of two years, to open up mines in such well known and productive gold-fields as those in California, Nevada, Australia, New Zealand, or Brazil, is not a matter for surprise. But it is a singular fact that in such a short time forty-four Companies should have been formed for mining in a country, from which, within the limits of recent history at any rate, no quantity of gold had been obtained, and the causes of these enterprises having come into such favour are a little difficult to explain.

In 1878 the Government of India had deputed Mr. R.

Brough Smyth to explore and report upon that portion of the Wynaad in which it was supposed that gold existed in payable quantity. His report published towards the end of the following year, showed that the opinion he had formed of the prospects of successful mining were favorable, in fact extremely favorable. His reasoning was summed up in the following paragraph :—

The reefs are very numerous, and they are more than of the average thickness of those found in other countries; they are of great longitudinal extent, some being traceable by their outcrops for several miles; they are strong and persistent and highly auriferous at an elevation less than 500 feet above the sea, and they can be traced thence upwards to a height of nearly 8,000 feet; near them gold can be washed out of almost every dish of earth that is dug; the proportion of gold in some of the soils and reefs in the neighbourhood of Devala is large; and the country presenting the greatest facilities for prosecuting mining operations at the smallest cost, it must be apparent to all who have given attention to this question that, sooner or later, gold-mining will be established as an important industry in Southern India.

Mr. Brough Smyth was a man whose opinions on mining matters generally were entitled to respect; for many years he had been Secretary for Mines in Victoria; he was looked upon as the greatest authority on the subject in Australia. The diligence and thoroughness with which he had conducted his explorations in the Wynaad were grounds for believing that the conclusions he arrived at were worthy of reliance; and the fact that actual crushings of quartz at the *Alpha* mine, with very inferior machinery, had yielded encouraging results, was certainly enough to induce capitalists to commence operations in a systematic manner in one or two of the most promising localities.

Some time before this, attention had been drawn to the tract of auriferous reefs running north and south through a portion of the Kolar district in the province of Mysore. It was known that the sands in the nullahs were year after year washed for gold by the villagers, and several desultory attempts had been made to sink on the reefs.)

It may be taken as an acknowledged fact that mining operations which have for their object the extraction of metal from

stone, require, in every part of the world, time for their development. In easily accessible countries, and where the conditions are favorable, six months or a year might elapse before any results could reasonably be looked for. In countries more remote, where difficulties in transport, an unhealthy climate, and inexperience of the characteristics of the mineral veins, have to be overcome, two years or more might be requisite. In India, where no systematic mining with modern appliances had yet been carried out; where heavy machinery had to be conveyed long distances over bad roads; where to many Europeans the climate is depressing and injurious; it was not reasonable to expect that gold-mining could be brought to a successful issue before the lapse of a longer period than is generally allowed for preliminary operations. And yet this consideration appeared to have no weight whatever with those who now began to invest their money in Indian Gold Mines. Companies formed in the earlier part of the year 1880 soon came into such high favour that by May, their shares were quoted at 50 per cent., 75 per cent., cent. per cent., and even a higher premium. But no fortunes had by that time been obtained by mining; and not only no fortunes, but no gold; the reefs had not been opened out, the machinery had not been shipped, and in most cases the mining staff had not even arrived on the ground. By October, the condition of affairs in India was still the same, a few more reefs had been struck, but no regular workings had been begun, and the monsoon had prevented much progress of any kind; shares had however continued to advance in value, and in one instance were quoted at 200 per cent. premium. By May of the following year, work on several of the properties was, as might have been expected, more advanced, but there was no prospect of any one of the companies being in a position to make a return for some time to come, and shareholders had begun to realize this fact; nevertheless high quotations were maintained both for those concerns which had been in existence for a year or more, and for those which had only of late been brought before the public.

I have endeavoured to show that the market was at this period ripe for a wild speculation of some sort or another. I now proceed to point out the causes which principally contributed to support the belief that the Indian mines would prove highly productive, and to maintain the values of shares at the irrational level they had reached. These were threefold; sensational reports from the companies' agents in India; ill-considered statements made by the Directors at home; and the machinations of those who pulled the wires from behind the scenes.

The sensational reports were generally sent by men who were merely in temporary charge of the properties, and whose responsibility in connection with them was of short duration; men whom it was convenient to employ for superintending operations until the services of an efficient Mining Engineer could be obtained. In some instances they had had a limited practical experience in the mines of other countries; in others their education had been merely theoretical, and the discovery of gold visible in the stone, raised in them feelings akin to alarm, and sent them off post-haste to the nearest telegraph station. The following are a few of the reports referred to:—

"Grand discovery, Needlerock reef turning out very rich, heavy gold."

"The leader in the Tea plantation has been uncovered, and has opened out into 4 ft. of magnificent reef, exceedingly rich in gold."

"I think the quartz on this estate likely to turn out very rich; it has the appearance of some of the richest auriferous quartz in the Bendigo gold-field."

"The whole mountain is worth putting through the stamps."

"Many new reefs and old workings discovered; especially fine two reefs, 6 ft. and 8 ft. thick; water, timber, and adit facilities splendid; free gold showing; continued exploring eminently satisfactory."

"The reef is 3 ft. thick and very rich; gold visible in the stone, and lots of good rough gold in the mullock."

The statements made by Directors, in the prospectuses, and at the general meetings of the various companies, were even more remarkable for the extremely hopeful view that was taken of the future. And coming from men who were naturally supposed to have made proper investigations, they probably did much more harm than the agent's reports. It is difficult to

believe that some of these Directors had any idea of what their responsibilities were, but it will be shown further on that the boards were often inherently weak boards. Some of these statements were as follows :—

"The Meeting would receive during the proceedings a statement of probable profits which would be derived from the working of the reef. From what was already known, it was expected that about 68,000*l*. a year might be reasonably taken as a minimum profit." (Cheers.)

"But the Directors base their estimate of profits on the more moderate yield of 1 oz. per ton . . . . . instead of estimating that 100 stamps and other necessary appliances would crush with ease 250 tons of quartz a-day, they estimate for 50 stamps crushing only 100 tons a-day."

"The quartz was there, and these were true fissure veins. The quartz was there in unlimited quantities. Even if it only contained 7 or 8 dwts. of gold to the ton, owing to the facilities of mining, the cheapness of labour and other circumstances, the company would be able to pay a good dividend; but from all parts of the gold fields there had been specimens taken and assayed; from the surface down to the 50 ft., and out of these places there had never been a specimen taken which had not yielded more than 1 oz. to a ton, and in some places they had gone up to 5 and 6 ozs."

"The Directors expect, before the expiration of twelve months, to be in a position to crush at least 50 tons of quartz per diem, and reckoning only 1 oz. of gold to the ton, at £3 10s. per ounce, the gross yield would be £52,500 per annum. The cost of mining, reducing, amalgamating, &c., may be estimated at £1 per ton (£15,000 per annum), which will leave a net profit of £37,500 available for dividends, or at the rate of 50 per cent. per annum on the entire share capital of the Company."

"If they drove 40 stamps and the return was only 1 oz. per ton, they would be able to divide something like 30 per cent. on their capital."

Many more specimens of this hyberbolical language might be given, and it was not the Directors alone who indulged in it. Mining Engineers and others, who had displayed a judicious caution in the expressions they had used while in this country, appeared to throw discretion away, when placed before an audience of shareholders at home.

If the Directors had done their duty, these extravagances would have been checked, but instead of that they were allowed full play, and shareholders generally left these meetings utterly bewildered at the fortunes that were in store for them.

The influence of Directors however, was but small as compared with that of the professional company promoters, and

financial agents, by whom the mania was bred, nourished, and supported. Of the majority of these people it is not unjust to remark that the ultimate success of the enterprise had no interest whatever for them. The establishment of the industry was a matter they cared nothing whatever about. Mining was a good enough thing in its way; if it had been ballooning, it would have made no difference to them. To draw out an attractive prospectus, to induce the public to subscribe for a certain number of shares, to force up the value of the latter, make as much as they could by disposing of their portion, and then clear out of the concern; this comprised the whole of their obligations to any undertaking. And if the public responded readily to the invitations to subscribe, the advisableness of clearing out quickly, and commencing afresh with some new venture of the same class, was obvious. The agencies by which they worked would be far too numerous to mention, even if a tithe of them were known; but the constant transfer, and re-transfer, of shares of the old established companies, was the one they had most resort to, and the one that was most effective; and the shares of nearly all the companies being at the low denomination of £1, a quotation could be established by the transfer of a very small sum. It was in vain that respectable journals, like the *Economist*, and the *Statist*, pointed to the recklessness with which new capital was asked for; while the fever lasted, the strongest warnings passed unheeded.

And thus the game of forming companies was kept alive; so much so, that the demand for mining properties out-grew the supply, and in the scramble to take advantage of the mood investors were in, several companies were brought out, not for mining on any particular land, but with the object of finding and purchasing a suitable estate. As was stated in the prospectus of one of them, they started "unfettered with any contract." Meanwhile the contagion had spread to this country. Nearly every planter in the Wynaad began to look up the reefs on his estate, and experiment on the alluvial, and many a one found sufficient encouragement to conjure up expectations of a rapid fortune. Numerous applications were made for leave

to prospect for gold on the Nilgiris, in Salem, and in Coimbatore, and the Mysore Government had a busy time of it granting similar licenses. But there was this difference between the people at home, and the people out here. The former were under the impression that there were gold-mines in India, the latter were aware that there was a gold-mine at home.

Every endeavour therefore was made on this side, to supply the British public with the mining properties it wished for; and great was the demand for persons capable of inspecting a piece of land, and reporting upon the prospects of successful mining thereon. Large sums were paid to mining engineers of experience, who happened to be in the country, and as there were not many of these, it is not to be wondered at, that men who had no experience whatever, soon came to the front and offered their services. Idle men who have tried their fortunes in different parts of the world, and who can talk glibly of the diggings at Ballarat, or of the mines at Grass Valley, can generally be found in any of the Presidency towns, and a good number of them were quickly attracted to the Wynaad and Mysore. And certainly, small blame can be attached to them for endeavouring to put their talents to some use; surely where a quondam baker, and a retired circus-clown, had succeeded in gaining the confidence of investors, there was a legitimate opening for some of them.

It was in fact the loafer's opportunity, and nobly did he strive to take advantage of it. One property after another was visited, examined, and reported upon, and somehow it was a very rare event indeed if gold was not discovered upon it. The self-styled mining engineer was usually of what might be termed a sanguine temperament; frequently he was imbued with the feeling that in common gratitude for the comfortable lodging, and sumptuous fare, provided by his employer, he ought not to condemn the property as being worthless; and sometimes there was an understanding that his fee should remain in abeyance until the property was sold, and that then it should take the form of a percentage on the price obtained.

The process of turning coffee estates, and other lands, into

gold-mines, therefore went merrily on; and the aggregate amount at which mining properties in Southern India were valued, towards the middle of the year 1881, must have been very much in excess of the sum of the National Debt. The mining engineers obtained such a thorough acquaintance with the geological features of the country, and became so expert at their business, that in several instances they ventured to report on, and to value, properties which they had never visited. Now in doing this, it certainly looks as if they had overstepped the bounds of strict morality. In describing and valuing lands which they had inspected, there was a possibility of course that their judgment might be led astray; but describing and valuing lands which they had never seen, almost amounted to an imposition upon the future purchaser. Nevertheless lands were purchased on the strength of such reports. And not only so, but in one instance a company was formed and advertized, for acquiring a piece of land, which had certainly been duly reported upon, but which there is very little probability of any one ever finding, no matter how diligently he may search for it, anywhere in Southern India.

Gold-mining however, like everything else, in time becomes monotonous, and the Indian mania had almost had its day. It rose up like a rocket, it fell like the stick. We have seen that in May 1881, the value of shares in the old established companies were at a high premium. Towards the end of that month, and early in June, prices were barely maintained, but on the 7th June it was announced in London that one of the principal mines in the Wynaad had commenced crushing, with the result of 4 oz. of gold to the ton of quartz. Immediately prices again advanced, and there was great excitement in the market. The opportunity which the professional speculators had long waited for, had come at last, and it may be surmised that few were so misguided as not to take advantage of it. It is said that at this period shares were sold at 400 and even 500 per cent. premium. Then came the collapse. On the 5th July a telegram was received from the manager, that 4 oz. was the yield of one ton only, and that subsequently 19

tons had been crushed, and had only given 2 dwts. of gold per ton. The disappointment felt by investors was severe; shares which had recently changed hands at £60, dropped at once to £20, and there was a heavy fall in quotations all round.

It is worthy of remark that, setting aside the mortification which was natural, when it was discovered that the production of gold was so very much less than was at first supposed, there was no good reason for being dissatisfied with the results of this experimental crushing. It indicated that quartz similar in appearance, was very irregular in quality, but that on the whole there was sufficient gold in it to leave a profit on the cost of extraction, if expenses were kept down to a moderate scale. And I take it that that is the present opinion of those mine managers who have had most experience of the reefs in the meanwhile. Investors however, who had placed a child-like confidence in all that their directors told them, expected much better things; and so the values of shares in the different undertakings continued to decline. Occasionally there has been a slight reaction, but on the whole, prices have had a downward tendency ever since. The reason is manifest; the professional speculators had cleared out. Never again has the British public been beguiled into laying down its money in looking for the mines of Ophir; the planter has returned to his planting, the mining engineer's report lies mouldering on the shelf; the mania has had its day, and has given place to other schemes, quite as reasonable; the search for Solomon's gold has been relinquished, the search for his wisdom has not been begun.

Such in brief is the history of the great Indian gold-mining mania of 1880 and 1881. Thirty-three English companies with a combined capital of £4,050,000 were now in the field, and mining operations on a very extensive scale had been commenced. The capital of a company however, does not always represent the amount of money which it is prepared to apply to the development of the business it undertakes; in mining, the proportion is less than in most other enterprises, in gold-mining it is least of all. In the case of the Indian gold-mines

a large deduction has to be made for the amount set down as the value of the land acquired. Upon what basis the valuations were made, is a question which cannot be satisfactorily answered. In the Wynaad in almost every instance, the properties consisted of grass lands and worn-out coffee estates which were unsaleable for any agricultural purpose, while in Kolar it was not pretended that the surface possessed any value. In some few instances, work had been begun, the reefs had been traced, and a small quantity of stone had been stored ready for the battery; as a rule, however, no prospecting whatever had been done, and the mining rights sometimes extended over only a small portion of the estate. Yet the prices ranged from £70 to £2,600 per acre; they depended upon the credulity of the investors, and the supineness of the directors. The total amount agreed to be paid for their ground by the 33 companies was £2,375,500, so that the sum left for working expenses did not exceed £1,674,500.

But it would be a mistake to suppose that even the latter figure represents the money that was actually available for working the mines. It must be understood that the vendors were always extremely reluctant to part with their property. They were so firmly convinced that the latter contained boundless stores of mineral wealth, that it was with the utmost difficulty the directors prevailed upon them to sell their rights at all, and they always insisted on retaining a large portion of their interest in shares of the company. The Stock Exchange, however, does not grant a quotation to a company which makes a payment in shares to the extent of more than one-third of its capital. So here a new difficulty arose; and it was often only after supreme efforts on the directors' part that the vendor was at length persuaded to accept 33 per cent. of the shares of the company, and a considerable sum in cash, in exchange for his lands and mining rights. The following five instances are taken hap-hazard from different prospectuses, many more might be given:—

"The vendor . . . . . accepts £26,666, part of the purchase money, being all that he can take in accordance with the rules of the Stock Exchange, in fully paid-up shares, the residue being payable in cash."

"The consideration has been fixed at £85,000, whereof the vendors stipulate that not less than £33,000 shall be paid in fully paid-up shares of the company."

"The amount to be paid for the property is £50,000, the whole of which would have been accepted by the vendors in fully paid-up shares, but for the rule of the Stock Exchange not allowing more than one-third of the capital to be taken up by the vendors in shares."

"The consideration to be paid for the property has been fixed at £75,000, of which £30,000 will be paid in shares and the balance in cash."

"The amount to be paid for the property is £60,000, all of which would have been accepted in fully paid-up shares, but for the rule of the Stock Exchange."

So unanimous indeed were the vendors in exacting the full number of shares permitted by the rule referred to, that 14 companies having a combined capital of £2,000,000 allotted the sum of £640,294,—almost exactly one-third—in shares to the vendors; and if we take the whole of the 33 Home Companies which proceeded to an allotment, we shall find that out of a combined capital of £4,050,000, as much as £1,140,000 was given to the vendors in the shape of paper.

It will be allowed that the desire on the vendors' part to accept a large proportion of the purchase money in shares, and thus to participate in the risks of the undertaking, appears to have been highly praiseworthy. That it was of ultimate advantage to the remainder of the shareholders is open to question. The matter must be looked into a little more closely. Payment in paper is no doubt very convenient to a company which is struggling to obtain the capital necessary for its existence; but when that payment is a large one, it must become later on, a very heavy tax upon the earning power of the company. In the instances I have especially alluded to, it would have reduced a 10 per cent. dividend to one of only 6⅔ per cent. That is, supposing a company had a nominal capital of £100,000, and had given £33,000 of its shares to the vendor; if it earned £6,700, it would have to distribute that sum as a dividend on £100,000. This consideration does not affect our present enquiry much, because unfortunately no dividends have yet been earned; but it serves to point out one advantage of a small payment in cash over a comparatively large one in

paper. Another advantage is this: if the vendors had been paid wholly in cash, arrangements would presumably have been made, by which the money would have been handed over by instalments, as is usual in other joint-stock enterprises; as it was partly in paper and partly in cash, such arrangements, as a rule, were not made. The vendor argued with some show of reason that the shares constituted the deferred payment, and that the cash must be paid without delay. The result was simply this; a company with only a small portion of its capital subscribed for, would proceed to allotment; it would get as far as paying a portion, or the whole, of the cash required for the land—the low denomination of its shares enabled it to do this, as the sum subscribed for could be called up quickly—; it would also, in most cases, be able to pay for its machinery, (a very important matter) and the passages of its mining staff; then, its resources being exhausted, it would languish for a while, and quietly sink into liquidation.

It is quite evident then, that the actual amount obtained from the British public for developing mines in this country was much smaller than the share capital of the 33 companies which were floated; and that what was available for working expenses was a mere fraction of even the nominal working capital. Also, that the sum of money that went into the pockets of the vendors, was very considerably less than the aggregate of the prices which those 33 companies agreed to pay.

The vendor in many instances is entitled to sympathy. Instead of getting a magnificent price in cash for his property, and owning besides, a third part of the shares of the company, he has found himself the possessor of a quantity of paper which is quite unmarketable, and has received only half, or three-quarters, of the sum promised him in cash. It may be suggested by some, that even then he was very well paid, because after all, the property was nothing more than an abandoned coffee estate, or a piece of waste land which had scarcely been proved to be auriferous. But really that argument has nothing to do with the question. The bargain had been concluded,

and it was not right that he should be defrauded of any part of his share.

Was the vendor justified in asking such a high price for his land? Undoubtedly he was. If he had brought to market, a horse instead of a mining property, there is no question that he had a right to ask £75,000 for that horse if he liked. It is equally certain that he would not have obtained that figure; which is the only good reason why he should not demand it. For the mining property he found that he could obtain an enormous price, and of course, he did so. He has been accused of knowing the property to be worthless; not at all; he may have known that it was of no use for agricultural purposes, but he did not profess a knowledge of its capabilities for mining. An expert had assured him that it contained stores of hidden wealth; was it likely that he would contradict him? It has also been suggested that he was aware that the money came out of the pockets of the widow and the orphan; but if the widow and the orphan choose to go about buying mining properties, surely that is entirely their own affair.

Not long ago, it used to be considered a suspicious circumstance if a company was promoted by the vendor of the property; but a remarkable feature about the Indian Gold Mines is that in nearly every instance the vendor and promoter were said to be one. This statement was generally made in a frank, straightforward manner, thus:—

"The Company is promoted by the vendor, by whom the consideration to be paid for the property has been fixed at £75,000.

The natural inference was that the directors, and others connected with the company, had done their best to induce him to take less, and had failed; this obdurate man could not be persuaded to abate his price. It is to be feared that this was not exactly the state of the case; the distinction between the seller and the buyer was not so sharply drawn. If an intending investor could have been introduced by one of the directors into a room full of the gentlemen interested in the new undertaking, it is not unlikely that the following scrap of conversation might have been heard. "No, that is not the

vendor," the director says, in reply to an enquiry, "that is the Solicitor to the Company, and that gentleman standing near the fire is the Financial Agent who has undertaken to bring the Company before the public; and he with the white waistcoat is the Company's Consulting Engineer, and next to him is the Engineering Agent in London; and those three on the other side of the table are Members of the Syndicate which takes a great interest in the welfare of the Company; and the man on their right is the Company's Broker, and next him is the junior partner of the firm which is going to supply our machinery, and to his left you will see the contractor who has undertaken to furnish us with all the tools and stores we require, and just behind him is the Company's Secretary, and that gentleman beyond him, in the corner, that is the vendor of the property." But he in the corner was probably not the actual owner of the land; in many cases the latter was transferred at constantly increasing prices from one name to another, and the ostensible owner was very likely only a poor clerk, in whose name it temporarily stood. Is it supposed that all these gentlemen were intimate friends of the original vendor, (the possessor of an abandoned coffee-estate, or of a concession from the Mysore Government) and that out of affection for him they were taking so much trouble to sell his property? The probabilities are in the other direction; the vendor was obliged to give up a very considerable share of the purchase money to some of them. What the amount of that share was is a matter which in gold-mining, as in other companies, investors and the public generally are not supposed to know anything about; but occasionally when the participators in the spoil have quarrelled over its division, some light has been thrown on the subject through disclosures made in Courts of Law. For instance it has been elicited that out of £45,000, the nominal purchase money paid by one company, £13,000 went to the promoters. In another case the price of the property was £75,000, out of which £30,000 was taken by the promoters; in another where the price was stated to be £85,000, the vendor received £55,000 only; and in another where £75,000 appeared in the prospectus as the price paid, £35,000 went to interme-

diary parties. It may therefore be said that instead of the promoter and vendor being one, they were many; in fact very many.

But after all, this was the vendor's concern, and his only. The shareholders gave him so much for his property, and it was nothing to them what he did with the money. The division between buyer and seller might still have been sufficiently clear; the vendor and his friends acting together on one side, and the directors guarding the interests of the shareholders on the other. If this condition of affairs had been instituted and maintained in the case of every company, the business would have been commenced at least on a comparatively satisfactory footing. That the vendor or vendors should come before the board, show the reports and valuations of the property, and discuss with the directors the terms on which it was to be taken over, seems an equitable mode of doing business. But it was not thus that matters were arranged.

An analysis of the composition of the several boards cannot be made here with any pretence at completeness; but without a knowledge of the ramifications of the various interests involved, it is certain that the case will suffer from being understated rather than over-stated. There are several names which appear upon the direction of more than one company, but for the purpose of analysis it will be convenient to deal with them as though they were separate individuals. It will then be found that the number of directors on the boards of the 33 companies as originally formed, was 175. A further examination will show that 33 out of these 175, had a direct interest in the sale of the land. In the case of twenty companies it does not appear that the vendors were represented upon the direction at all; in the case of five companies they had a small share in the direction, and in the case of the remaining eight companies their share was a large one. In one instance out of five directors, three were the actual vendors. I do not mean to say that it was attempted to conceal this arrangement from investors; in some of the prospectuses the fact was stated plainly enough, in others it was somewhat obscure, but at all

events investors had the same means of ascertaining how matters stood, as those which are made use of in the present enquiry. My object is to show that in very many cases the constitution of the board was such, that it was impossible for the directors to take an impartial view of what was best for the interests of the shareholders. One might as well expect justice in a Court of Law in which the functions of prosecutor, witness, and judge, were rolled into one, as one would look for impartiality on a board where the vendor, promoter,* and director, were represented in the person of the same individual. Practically what often took place was this. The obdurate owner of an abandoned coffee estate, or a piece of waste land, fixed the price for it at £75,000, and would not give way, because the director (himself) thought it was fully worth the money. The hopeful director was in favor of proceeding to an allotment with only a fifth of the capital subscribed for, because there would then be some cash available to pay off (himself) the vendor. It may be argued that he did not join the board until the allotment had taken place; but it is well known that as a matter of fact, his influence at the board, dated from the first inception of the undertaking.

The remaining directors consisted for the most part of three classes; those who had an indirect interest in supplying machinery and other mining plant; those whose profession it is to obtain seats on the boards of all sorts of companies, and who have earned in the City the name of 'Guineapigs'; and lastly, retired Indian officials who, with a good deal of unaccustomed spare time on their hands, are glad to obtain the little occupation and excitement which the office of a director affords. Of the first class I say advisedly an indirect interest, because, the Stock Exchange rules require that a director shall vacate office if he be a member of any corporation which has entered into contracts, or done any work for the company; and in the list of the original directors there will not be found many names—not more than three or four—which are known to be directly connected with foundries or engineering works. It is certain, nevertheless, that in many of the companies there

were directors who were on more or less intimate terms with certain firms, and that their influence at the board was considerable. As regards the second class, it is remarkable to notice how few of them were connected with the gold-mining enterprise in other parts of the world, and beyond the privilege of paying them handsome fees, it is difficult to tell what advantage shareholders gained from their presence at the boards. About the third class, the Indian officials, there is this very noteworthy fact; very few of them had served in Southern India. Great efforts were made from the first to induce some retired officers from Madras and Mysore to join the boards of the different companies, more especially a gentleman who had acted as Governor of Madras, and another who was for some years Commissioner of the Nilgiris. From some unexplained cause these efforts were unsuccessful. In the list of directors of the 33 companies there will certainly be found several Madras officials, but they have already been enumerated among the vendors. Apart from these, out of the 175 directors, there were 41 old Indian officers of the Civil and Military services; and out of these 41, only four, or at most five, had served their time in the Madras Presidency, or in the province of Mysore. The remaining 36 belonged to other parts of India; many of them were distinguished officers, and no doubt their names often formed an attraction to investors; but their special qualifications for prosecuting a search for gold are not apparent. It does not follow that because a man has for many years been known as a brave and energetic soldier in the Punjab, or as an eminent judge in Assam, that he is well fitted for directing a mining venture in the Wynaad. It is more likely that he will not only want experience in mining matters, but will also be entirely in the hands of his associates at the board in matters of business. This is in fact what was generally the case. Investors at home probably thought that the local knowledge of these retired officers would be of great value; people out here must think differently. The requirements of the country and the climate, the supply of water and fuel, the cost of labour and timber, the systems of land tenure, &c., are subjects which people who have not visited the districts in question, generally

know very little about, and the statements made at many of the meetings showed that local knowledge was a very rare article. One amusing instance may be cited. The directors of a company which had failed in securing some particular property in the Wynaad, strongly recommended the shareholders to purchase an estate on the Shevaroy Hills. Now it needed very little local knowledge to have told them that the whole of these hills is composed of massive horneblendic granite gneiss, that there are no reefs in it, only lenticular masses of quartz, pure white, and as unpromising as they can be for the occurrence of gold. The chairman of this company had spent many years in India and yet it apparently never occurred to him to consult the publications of the Geological Survey,* where he would have found complete information regarding the structure of the Shevaroys. It is only fair to add that this is perhaps a particularly unfavorable instance of want of local knowledge, because the same directors having for some reason abandoned the Shevaroys, strongly recommended the shareholders to take up a property on the west coast of Africa. The company was evidently bent on mining for something, somewhere; what a pity it is that they could not get hold of a corner of Salisbury plain.

To summarize the conclusions arrived at, it is the directors, and not the vendors, or promoters, who are to blame for the exorbitant prices paid for the lands, and for the companies being formed on hollow foundations. Every man has a right to ask what he likes for his own property; it is the buyer's business to beware. When he who acts for the buyer is in reality hand-in-glove with the seller, the buyer's interests are more than likely to suffer.

Ventures put forth with such little regard for business principles could be but short-lived. Within a very few months the weaker ones either went into voluntary liquidation, or were ordered by the Court of Chancery to be wound up. Sometimes that Court took the occasion to express a very

* Mem. Geological Survey, India, vol. IV, p. 223.

strong opinion regarding the manner in which the companies had been formed; but after all their mission was accomplished. It is possible that some of their directors may have supposed that mining was their ultimate object, but in reality they were merely organisations for putting money into the pockets of the vendors and promoters, and the suppliers of machinery. Up to the present time 15 out of the 33 companies have passed into the hands of the liquidator.

It has been convenient to class together these 33 companies which were formed at home ostensibly for the same objects; but it is time to point out that there were some which had a more solid foundation and a considerable reserve of capital, and which have been directed by clear headed men of business who have had the shareholders' interests at heart. By a process of very natural selection, it is in most cases the fittest to survive, which have survived up to the present time. I do not mean it to be inferred that the distinction between the genuine mining companies and the spurious, should be considered identical with that between those which are yet in existence and those which have been forced into liquidation. There are several of the former which as mining adventures, must ere long cease to exist; some of them were turned into gold-mines because they did not pay as coffee-estates, and they will have to be turned into cinchona-estates because they do not pay as gold-mines. On the other hand, some of the companies now in liquidation possessed lands which may possibly contain stores of the precious metal; the question whether they did so or not, it was never seriously attempted to prove.

The difficulty of obtaining their balance-sheets renders the task of examining into the present financial condition of the existing companies a troublesome and unsatisfactory one, but from reports published in the *Mining Journal*, and other papers, the following particulars are obtained. The *Indian Glenrock* Company was formed in February 1880, and amalgamated last year with the *South Indian* Company; their combined capital is £240,000, out of which they paid £108,000 for their lands, leaving a working capital of £132,000; on 31st March

1882 they had £82,250 in hand, but this sum comprised £25,144 in shares of another mine, which shares were practically unsaleable. The *South-East Wynaad* Company was formed in January 1880 with a paid-up capital of £100,000; it paid £56,000 for its property, leaving a working capital of £44,000; by the end of last year this sum was exhausted, and the company is now carrying on work on money advanced to it by one of the directors. The *Devala-Moyar* Company was formed in June 1880, with a capital of £200,000; it paid £132,000 for its land, leaving a working capital of £68,000; it obtained besides, the sum of £130,000, for a small piece of land sold to the *Rhodes Reef* Company, and paid a dividend of £100,000 out of the proceeds; on 30th September 1882, it apparently had in hand £50,000. The *Rhodes Reef* Company was formed in November 1880, with £60,000, out of a total capital of £190,000, available for working expenses; at the end of 1881 it had £48,000; no information is obtainable as to what has been spent since. The *Wynaad Perseverance* formed in September 1880, with a capital of £80,000 paid £50,000 for its land, and out of the remainder, possessed on 31st May 1882 £5,800. The *Indian Phœnix* Company was formed in October 1880, with a paid-up capital of £150,000; its land cost £86,000, and on 31st December 1881 it retained £42,000 of its working capital. The *Devalah-Central* formed in November 1880, with a capital of £99,000 gave £70,000 for its land, and on 31st December 1881 had £13,000 left in hand. The *Indian Trevelyan* was formed in February 1881, with £150,000 for its total capital; its land cost £100,000, and on 31st December 1881, it had a balance of £39,000 in hand. The *Indian Consolidated* Company was not formed until June 1881; its paid-up capital is £400,000, and its properties cost £275,000; on 30th September 1882, the balance it had in haud was about £73,000. The *Wentworth* Company formed in June 1881, had a capital of £120,000, gave £80,000 for its land, and has about £10,000 in hand besides £20,000 uncalled. The *Tambracherry* Company formed in February 1881, with a capital of £160,000, paid £120,000 for its lands, but subsequently sold a portion to the *Cootacovil* Company for £60,000, out of which it distributed £20,000 in divi-

dends, and on 30th April 1882 had a balance of about £44,000. The *Cootacovil* Company formed in June 1881 had a nominal capital of £100,000, and paid £60,000 for its property, and on 30th June 1882 had £24,400 still unspent. The *Colar* Company started in August 1880, with a subscribed capital of £75,000, and the price of its property was £40,000; its balance in hand at present is approximately £6,000. The *Mysore* Company formed in July 1880 with £135,000, paid £55,000 for its land and has now about £25,000 left. The *Ooregum* with a capital of £125,000, paid £75,000 for its land, and has nothing left. The *Nundydroog* started with £76,929, out of which it had to pay nearly £50,000, for land, and its working capital is also now exhausted. And lastly, the *Nine Reefs* Company formed in May 1881 with a subscribed capital of £91,500, gave £60,000 for its land, and at the present time has apparently about £16,000 in hand. These 18 companies are the remnants of the band of 33, which were heralded forth with flaming prospectuses and scientific reports some three years ago.

From the foregoing figures it will be seen that they had to begin with, a combined capital amounting to £2,492,500 to which £190,000 must be added, being the amount realized by re-sales of land. If the figures are examined more closely, and a fair allowance is made for expenditure up to date, the amount of capital still unspent may be calculated approximately at £306,000. If this calculation is correct, and we deduct besides the aggregate amount paid for the properties, and which may be set down at £1,546,500—the sum of £130,000 for uncalled capital and calls not paid, then it would appear that the money which has been actually spent, amounts to about £700,000. Now there may be some curiosity to know how this sum been expended.

Here again the want of balance-sheets of the varions companies is an insurmountable obstacle to arriving at accurate conclusions, but from the papers before me, I submit the following estimates in the belief that they are not far

from representing the manner in which the money has been allotted :—

Law charges, conveyances, &c.	£71,000
Home management, including Directors fees, Secretaries' salaries, office expenses, &c. ...	69,000
Agencies in India	14,000
Travelling expenses	18,000
Sundries	22,000
Machinery and plant, cost of carriage, permanent works, &c.	338,000
Mining including wages of mining staff, cost of timber, explosives, &c.	168,000
Total...	700,000

The question which is here led up to is, whether, if the companies had been formed for the development of any other industry, and had adjusted their expenses in the same manner, they would have succeeded in establishing that industry and in making it remunerative. Without going further for comparisons than to those industries which have already been established in this country by the aid of British capital, would cotton-spinning, jute-weaving, paper-making, sugar-refining, or brewing have been successful if they had been attempted on the same conditions? If out of a capital of £100,000 a company formed for any one of these objects, paid during the first three years of its existence, £62,000 for its land, £8,000 for home management and other charges, £14,000 for its buildings and machinery, and only £8,000 for working expenses, what hope could there be of its becoming a dividend earning concern? It would surely be only a waste of time to show that it could not long escape falling into the liquidator's hands. But it may be objected that the only land it required would be a building-site, for which the sum of £62,000 would obviously be excessive. Then let us compare a company formed for acquiring land for a tea plantation, or a coffee estate. Is there one which has given away two-thirds of its capital for

its land, and spent nearly all the remainder in three years in bringing its trees into bearing ? If there is, and it has been successful, its name does not appear on the list of existing companies. But it may still be objected that a mining venture is different from either a manufacturing or a planting one, and that in expending so large a proportion of its capital on its land, a mining company is in reality providing itself with its raw material. This is a somewhat remarkable way of looking at the matter, but it is one that was in great favour among promoters a short time ago. The argument is so very hollow that it is almost unnecessary to say, that although the quartz is the raw material, until it has been broken from the reef and brought to the surface, it possesses no value as raw material, or as anything else. But we can still find a comparison among the industries established in India; there are in Bengal seven coal-mining companies working successfully and paying dividends, but not a single one among them which was so prodigal in the expenditure of its capital as it has been shown that gold-mining companies have been.

This will be a convenient place to remind my readers that Mr. Brough Smyth did not fail to foresee that failures would arise, nor to prophesy correctly their cause. Of late he has been very much abused for the part he took in attracting capital to the Wynaad Mines, and in justice to him the following extract from his report is given :—

"It is not unlikely however that the first attempts will fail. Speculative undertakings having for their object the making of money by buying and selling shares are commenced invariably by appointing Secretaries and Managers at high salaries and the printing of a prospectus. This is followed by the erection of costly and not seldom wholly unsuitable machinery; no attempts are made to open the mine; and then after futile endeavours to obtain gold and a waste of capital, it is pronounced and believed that gold-mining on a large scale will never prove remunerative.

It is probable that this story will be repeated again and again, here as in other gold-mining countries, until some one of the mines is opened by experienced persons who desire to secure profits, not by dealing in shares but by mining.

I now come to notice the six mining companies which were formed in this country during the mania of 1880-81.

It was only natural that people out here should take a more moderate and reasonable view of the prospects the industry had, than that which was adopted by investors at home. Company-promoters in London might excite the imaginations of their hearers about the glowing riches of Southern India, but a hard experience had taught sojourners here, that up to date it had proved rather a poor country. Ancient history, sacred and profane, might be referred to with considerable effect, in Cannon street Hotel, and traditions of Oriental wealth and splendour rouse the listeners to enthusiasm, but in Madras the rejoinder would most likely be that India is a land of shams and delusions, and that traditions, as a rule, are not worthy of much dependence. The apathy of residents here on the subject of the gold-mines was accounted for as follows by a very well known London share-broker.

"It was generally the case that when a man has a thing under his nose he does not believe in it, because he sees it too frequently, and when an enterprise was developed by people afar off, these people of course said they "knew nothing about it." The fact was a man in Madras knew less about what was taking place a few hundred miles away from him than they did who were as many thousand miles away from the properties. These properties were about to be developed with skilful management, and with English capital, and when the time came that the Indian native bankers woke up to the fact that there is gold at their doors, and that they were out of it, a very keen competition would arise for the shares of these gold-mining companies we had acquired." (Cheers.)

The benighted condition of the people of this land (Southern India) has frequently been a source of regret and solicitude to writers in the other Presidencies, and it was only natural that it should engage the attention of a man with such wide sympathies as this celebrated share-broker. As a matter of fact however, investors here were very early in the field of speculation. The original *Ooregum* Company, the first venture in the district of Kolar, was formed in November 1879; its capital was Rs 70,000, out of which it gave only Rs 20,000 for its land; therefore it started with very fair prospects. Before it had been in existence six months however, an offer of £45,000 was received from a London company-promoter for the property, and as this gave the shareholders a profit of nearly 700 per

cent., the offer was not refused. Finding that the mine had been so productive, a second company, the original *Madras*, was formed in June 1880, to take up a block of land in the neighbourhood. This company had a capital of Rs 10,00,000, and it gave Rs 5,00,000 for its land. It also succeeded in conducting mining operations (in London) with considerable success, for within six months' time its land was purchased for £100,000. A third company, the *Balaghat*, was formed privately in December 1880, with a capital of Rs 3,60,000. It paid Rs 1,20,000 for its land, but was too late to resell it at home before the mania collapsed; so it has set to work at mining with considerable vigour, and at present has Rs 30,000 left out of its original working capital of Rs 2,40,000.

The Bombay companies are three in number. They were all formed when the mania at home for mining was almost at its height, and their balance-sheets show how easy it is for a wild speculation to plant its foot in that very progressive city. The *Wynaad* Company formed in September 1880, has a paid-up capital of Rs 4,65,000, gave Rs 1,50,000 for its property, and out of a working balance of Rs 3,15,000 had on 31st July, 1882, Rs 11,490 in hand. The *Ripon* Company, formed in August 1880, has a paid up capital of Rs 2,20,000, paid Rs 1,00,000 for its land, and on the same date had Rs 19,113 left. The *Kaiser-i-Hind*, which was formed in December 1880 with Rs 12,00,000, capital, of which Rs 9,43,000 is called, paid away Rs 7,50,000 for its mining rights and has now about Rs 10,000 in hand.

The last to be noticed is the *Indian Gold Mines* Company, with a capital of £110,000; the price of whose property was £10,000, and an interest in the future profits. This venture is one which has excited more general interest than any of the others, because it was formed very shortly after the collapse of the City of Glasgow Bank, and its promoters had in view the philanthropic aim of benefiting the ruined shareholders in that institution. A scheme with such high motives, even though it be a Gold-mining Company, cannot fail to evoke sympathy. The Company was formed long before the mining mania began, and its works are more extensive and elaborate

than those of any other; it has spent up to date about £90,000 besides the purchase-money paid, and consequently has some £10,000 to go on with. Besides its own ground, it is working that of the *Southern India Alpha* Company, a company which was registered in Madras so long ago as 1874, and was in fact the pioneer venture in the Wynaad, but which has now transferred its head-quarters to London.

A writer, with a love of epigram, has recently stated that five millions of pounds have been spent in searching for gold in India, and only five pounds worth has been obtained. The statement is more epigrammatic than it is truthful. The amount of money nominally devoted to the development of the industry has been shown to have been £4,400,000. Of this sum £1,237,000 was merely paper handed over to vendors in part payment of their lands, and about £900,000 is a fictitious amount supposed to have been raised by bubble companies, but really never even subscribed for. Of the remaining sum, about £1,195,000 represents cash that has gone into the pockets of vendors and promoters, so that what has actually been available for working the properties, including cost of plant and machinery and home charges, is not more than £1,068,000.

The amount of gold which this sum has produced is about 630 ounces, the published returns being as follows :—

Prior to 1880.	Quartz treated. Tons.	Yield. oz. dwt. grs.
Southern India Alpha Company	779½ ...	91 ... 12 ... 23
Prince of Wales Tribute	323 ...	160 ... 18 ... 12
1880.		
Ooregum Company	44 ...	40 ... 10 ... 0
1881.		
Indian Gold Mines Company	26½ ...	7 ... 15 ... 0
1882.		
Balaghat Company	310 ...	32 ... 0 ... 0
Indian Phœnix Company	768 ...	136 ... 10 ... 0
Indian Glenrock Company	400 ...	20 ... 4 ... 0
Rhodes Reef Company	1,200 ...	45 ... 0 ... 0
Colar Company	50 ...	2 ... 10 ... 0
1883 (First quarter.)		
Ooregum Company	100 ...	77 ... 0 ... 0
Indian Phœnix Company...	100 ...	20 ... 0 ... 0

It has been stated over and over again of late that there is no gold in India, or at any rate not enough of it to pay the expenses of extracting. People who take this view belong to the same class as those who, after the collapse of the great Railway mania at home thirty-five years ago, said that that there was no traffic in England, or not enough to pay working expenses. That there is a considerable quantity of gold in the country, and that it is very widely distributed has been proved beyond all doubt. Whether it occurs in sufficient quantity to pay for the cost of extraction is manifestly the question upon which the future of the industry to a great extent depends. It has however been shown that so far, there have been comparatively few really zealous attempts to show that mining can be made to pay, and all that can therefore be said at present is that the question still remains to be proved. It is not by such trials as have been made hitherto, not by crushing a thousand tons nor even twenty thousand tons that the problem can be solved. After all the money that has been thrown away in England and in India, after all the high expectations and disappointed hopes of the past three years, after all the vapourings of brokers, directors, and promoters, there still stand out these facts :—that gold was produced in quantity in Southern India in former times; that there are extensive formations in which, competent geologists and mining experts consider the indications favorable for its production now; that supplies of the chief requisites for successful mining —labour, water, and timber—are abundant. To give reasons for a belief in the ultimate success of the industry would be mere waste of time, because they would at best only amount to an argument that gold ought to pay, and as long as it does not pay, what it ought to do will be thought of no consequence. A single success, the distribution of one dividend obtained by the reduction of the ore, will do more than many pages of argument.

It may be of some use however, to enquire further into the reasons why the expectations of speedy results have remained so long unfulfilled. It will be said that after making ample

allowance for all the bubble mining ventures, there are at any rate some companies left whose fidelity of purpose is undoubted, and yet there is not one which has commenced to make regular returns of gold. The explanation seems to be that the laboriousness of the preliminary operations in the different districts has been very much underrated.

In the Wynaad the difficulties which have been met with have been very great, far greater than anything that was foreshadowed in Mr. Brough Smyth's report, or by other mining experts when the various companies commenced operations. Mr. Brough Smyth took pains to point out the existence of extraordinary facilities for mining, the abundance of fire-wood and timber, and supplies of running water available for washing gold, or for driving machinery. But he did not properly appreciate the obstacles to bringing that machinery to the spot, and erecting it; he lost sight of the fact that in order to make the water power, which he so much extolled, effective, it would be necessary to construct mill-races miles in length, and to cut roads through heavy forest and dense jungle. He contrasted the cost of labour in Australia with the low wages paid to coolies in this country, but he failed to appreciate the enormous discrepancy between the results obtained by a few skilled English workmen, and a horde of ignorant natives, apart from the difference in the effective power of man and man. He omitted all mention of the absence of foundries and engineering works, where tools and machinery might be made or repaired, and thus left altogether out of his calculation the delays involved by having to send to Madras or Bombay for every small appliance that was found wanting, or else having to await for months its arrival from England. He made light of the reputed unhealthiness of the Wynaad climate, but he forgot to allow for its depressing effect during a great part of the year on the energies of men accustomed to colder and drier regions.

The distance between the principal mines and the coast is not great, 30 or 40 miles at most, but in that distance, an ascent has to be made of over 3,000 feet. If the means of

transport were good, there would be nothing formidable in this; but the roads are bad, in the monsoon often impassable, the bridges have frequently given way, and as a rule the only animals available for draught have been bullocks. It is therefore not to be wondered at that the time occupied in getting heavy pieces of machinery from Beypore has often been measured, not by days, nor by weeks, but by months. The delays in transport of machinery and materials, in building, and the construction of surface works such as roads and mill-races, have been aggravated by the occurrence of an unusually heavy monsoon; and the tardiness in opening out the reefs and extracting the quartz may in some degree be accounted for by the unskilfulness of the native workmen, and the frequency with which English miners have been incapacitated by illness.

In the mines around Devala and Pundalur in South-East Wynaad, a great deal more attention has been given to surface works than to purely mining operations. To obtain results, it is obvious of course that both must be developed; and the question as to the proportions in which this should be done is one that may be left in the hands of the able mining engineers who are in charge of the works. It must be remembered that I am viewing the question from the economist's standpoint, and not from that of the miner. I believe however that it is now generally admitted that mistakes have been made in sacrificing too much to the obtainment of water-power for the crushing-machinery. In some instances the site selected is at a long distance from the reefs, and the cost of conveying the quartz to the mill will be considerable. In some cases also the force of water is too small to drive a large battery, excepting in the wet season; this will partially account for recent delays. But it is also to be noticed that the principal engineers have recognised the fact that no very large quantity of rich quartz can be depended upon, and that in order to keep the cost of reduction down to the level of a low out-turn, it will be necessary to put a very great quantity of stone through the mill daily. They are therefore not attempting regular crushings until they find themselves prepared to do this.

Lastly, the cause of delay in the Wynaad has in some cases been want of funds. The prodigality with which money was squandered in the earlier days is bearing fruit, and the cash which is so urgently needed now to bring the work to a successful issue is not forthcoming.

In the Kolar district the absence of results is attributable to different causes. There has been no lack of lavishness in expenditure there, and in several cases it is the want of cash that is now crippling operations. But the money has not been spent in transporting machinery and plant to the field; the railway is only seven miles distant, and the road to it is comparatively a good one. There has been no occasion for a large outlay in endeavouring to obtain water-power, for there are no streams capable of turning machinery. Forest and jungle there is none, and one long road through the different encampments is all that has been necessary for communication and transport. How is it then that there have been no successes? The chief reason seems to be that mining operations have been commenced on lands which had never been properly prospected. On the *Ooregum* land a good deal of work had previously been done, but on the other properties the continuity of the reefs had not been proved, and their existence at all was a matter of speculation. Investors have only themselves to blame when they take up one square mile because the next one to it contains gold. They forget that the nearest boundary of their land is perhaps two miles or more from the spot on which gold has been discovered; and they probably do not know that in other countries a reef may be very rich in one part, and entirely barren at a few yards distant, may be found close to the surface here, and be several hundred feet down there. However, it must still be borne in mind that on some of the lands little or nothing has been done to prove that the reefs do or do not exist. The deepest shaft sunk by one of the companies at present in liquidation, is 45 feet down, while another has made no pretence at sinking at all. There appears to have been a want of proper mining explorations such as would be carried on in any new field in Australia. In the *Ooregum* and *Balaghat*

mines where sinking has been continued to 120 and 130 feet large and paying reefs have been found, and in some of the other mines it seems only reasonable to suppose that similar discoveries will result. It is stated that in the *Mysore* mine, where the deepest explorations have been made, old native workings have been found at a depth of 120 feet. When these old workings have been followed down elsewhere, it has generally been found that they do not continue far, and that where the working has been abandoned, the reef left is still rich. 150 feet appears to be the extreme limit which these old workings have reached, while to a miner trained in Ballarat or Sandhurst, 1,000 or 1,500 feet would, with proper appliances be a matter of little difficulty.

Some of the arguments put forward now against mining are as untenable as those urged three years ago in support of it. One reason given by a gentleman in Bombay that the industry at Kolar can never pay is worth mentioning. He says that in the old times the mines were worked by slaves, whereas now paid labour only is available. This argument has little force unless we put out of the question the advantages gained by the use of modern machinery. If we do that however, it may yet be asked, were these slaves clothed? if they were, it is quite certain that the cost of clothing was greater then than it is now; and that cost their employer must have borne. But if they were not clothed, possibly they were fed, and it may be presumed that with hard work they eat with some relish. As their employer had to provide them with food, he does not seem to have been altogether in a better position economically, than the companies which in these times have to give their coolies 3 or 4 annas each per diem.

The way in which money has been applied to the purchase of machinery in quantities out of all proportion to the work done underground, is on this field very noticeable. Nearly every company had to commence with a supply greatly in excess of its probable requirements for the next three years. The quartz obtained at one mine does not exceed five tons, and yet there is a complete set of reduction plant on the ground; at

another mine a large battery has been erected, and a tank made, while there is no supply whatever of quartz to treat. The matter is partly explained when it is ascertained that a great deal of this machinery was sent out from the Sandycroft foundry at Chester. If the money that has been squandered in its purchase had been spent in deep sinking instead, it is possible that the results in some cases would have been different from what they have been.

The time occupied in developing the Indian gold-mines has certainly been long, but the reasons here given will, to some extent, account for the delay. It may be said with some confidence that the time is now near at hand when, in the Wynaad at any rate, the existence or the non-existence of gold in payable quantity will be an established fact. The results of crushing operations during the approaching monsoon will therefore be looked forward to with no ordinary amount of interest. In Kolar it is to be regretted there must be further delays; the only two companies which have sunk deep and found a large supply of rich stone, are hampered in their operations by the want of funds.

Early in this paper it was stated that besides the 44 companies brought out at home in the years 1880 and 1881, for searching for gold in India, there were 48 whose object was to search for it in other parts of the world. At this stage it may be asked whether any of them have succeeded in developing their mines in a shorter time than has been done in this country. I have no means of finding out what proportion proceeded to allotment, but out of the 48 companies, only 24 are in existence at the present day. Of these 24, not one has yet declared a dividend, and it also appears that not more than six have commenced regular crushings, although the majority of them are conducting operations in countries where the industry has been established for many years. A further examination of the list of mining companies, whose head-quarters are in London, reveals the following facts. There were at the commencement of this year 297 companies, of which 146 were undeveloped mines and 62 had never paid a dividend, so that

208 out of the 297 were losing concerns. Of the remaining 89, only 51 paid a dividend last year. The number of London managed gold-mines was 87, of which only six paid dividends, and the average earnings of those six were only 6⅞ per cent.

Nevertheless it is well enough known that in many countries the industry continues to be highly remunerative. In Victoria for instance, the dividends last year amounted to £800,000, and were thus nearly double the aggregate amount distributed by all the banks, insurance companies, and other joint-stock undertakings in the colony. In Colorado and California the profits made last year were on a magnificent scale, and in many other countries the returns showed no falling off. It would seem then that the absence of profits is due to other causes than paucity of the metal. What those causes are has been sufficiently indicated in the preceding pages.

Experience has taught that the cost of bringing a mine into working order in this country is very much greater than was at first supposed. It follows then that a company should possess a large reserve of cash, and certainly the best way of keeping that reserve is in the form of uncalled capital. Obviously then it is bad policy to place the shares at a low denomination, and to call up the whole or the greater part of them forthwith. If however the capital is called up quickly, no greater mistake can be made than to dissipate it at once in the purchase of unprospected land and unneeded machinery. It is only in rare instances that payable stone will be found at the surface, and sinking shafts or driving tunnels to even a moderate distance will always, under existing conditions, necessitate a considerable outlay in money and a considerable lapse in time. When however a mine has been got into working order, it will be absolutely necessary to keep expenses down to a far lower scale than has hitherto been done in any single instance. In other countries, the industry does not, with one or two exceptions, seem capable of standing the cost of Home management, and it is therefore unreasonable to expect that it can do so in India. Freed from the burden of a London board and its collateral expenses, there appears to be no suf-

ficient reason why a mine should not be worked as cheaply here as it can be in most other parts of the world. That this has scarcely been attempted so far will be apparent on comparing the expenses of any one of the existing Indian companies with those of a properly worked Australian venture. I take the balance-sheet for six months of one of the companies formed in Bombay, and a recent balance-sheet for a similar period of a well known company in the Sandhurst district, and as far as practicable put each item of their expenditure side by side. The Bombay company has a capital of Rs 6,50,000, of which Rs 3,15,225 has been called, and its preliminary expenses have already been written off; the Sandhurst company has a capital of £33,000 of which £22,000 has been called :—

	Bombay Company.			Sandhurst Company.		
	Rs.	A.	P.	£.	s.	d.
Wages	11,363	1	10	7,064	17	6
Travelling	2,849	10	6	...		
Stores	2,694	5	1	1,021	14	7
Machinery	...			762	0	1
Mining and Milling	6,680	2	5	1,606	8	9
Charges	2,371	10	5	...		
Agency	1,950	0	0	...		
Law	927	9	0	...		
Advertising	168	8	0	12	8	0
Sundries	1,304	8	7	107	9	11
Management	3,610	0	0	72	0	0
	Rs 33,919	7	10	£10,646	18	10

The advantage on the side of the Bombay Company in the cost of labour is at once apparent. Travelling is an extra item, but on the other hand the Sandhurst Company had to pay heavily for stores and machinery, while the Bombay Company, having no reduction works, paid very little; allowing for this circumstance, there is no great discrepancy in the charges for mining and milling. But then come six items which in the Bombay account aggregate Rs. 10,332-4-0, while on the Sandhurst side they are represented by £191-17-11; these are charges for stamps, stationery and telegrams, and fees to lawyers, directors, agents, and auditors, &c.; in other words money spent in management. It therefore appears that of the total expenditure for six months, the Bombay Company devot-

ed 70 per cent. to the development of its mine, while the Sandhurst Company devoted 98 per cent. to the same object; the charges for management in Bombay amounted to 30 per cent., while in Sandhurst they were not quite as much as 2 per cent. The Bombay Company is probably the most economical of any of the Indian mining companies whose balance-sheet has yet been published, while the Sandhurst Company is only one instance out of very many well-conducted mining ventures in Victoria. During the six months the Sandhurst Company distributed £21,786-1-0 in dividends, or nearly cent. per cent. on its paid-up capital. It raised and treated 8,198 tons of quartz, the yield being 8,059 oz., say one ounce per ton. Supposing the quartz had given only 8 dwts., the yield would nevertheless have paid all expenses, and allowed of a dividend of nearly ten per cent. besides. What return would have paid the Bombay Company it is impossible to say, because we do not know under what conditions the quartz, if obtained, could be reduced, nor can we tell what additional charges the reduction of it would involve. But it would appear that if the yield left a surplus of 50 per cent. over the costs of mining and reduction, the whole, or the greater part of that 50 per cent. instead of being divided among the shareholders, would have to be applied to pay the costs of management.

Mr. Brough Smyth estimated that a yield of 2 dwts. per ton would cover expenditure; not in any single instance yet has this been corroborated in practice, and it is certain that no reliance should be placed on estimates of this description. It is only by practical experience in working that any trustworthy estimates can be formed. The conditions under which mining can be carried on vary in different districts. In one, while timber and firewood are ready to hand, the cost of carriage is enormous; in another, where communications are easy, the price of wood is excessive, and there are difficulties in sinking; in a third, where labour and wood are abundant, the amount of water in the ground involves a great expense in pumping. Taking everything into consideration however, there is reason for believing that in some districts where the conditions are

favorable, a yield of 2 dwts, or even less, may be made to pay expenses, after the industry has been properly established. It is evident that the cost per ton to any company will be regulated by the capacity of its reduction works; if it can treat 10,000 tons in the year, a lower yield will be remunerative than if 5,000 tons represent the extent of its crushing capacity. Since as a rule the Indian quartz is poor, it follows that a mining enterprise can scarcely be very remunerative until it possesses a large crushing plant, and has its mine so far developed as to obtain large quantities of stone daily. It is certainly true that very rich pieces of ore have been found in many localities, but from the results of crushings so far, it is unreasonable to expect that, taking one thousand tons with another, the yield will be anything but a low one. To those companies who thoroughly recognize this fact, success is likely to come the soonest. The expectations, the positive calculations of a regular out-turn of one ounce of gold per ton, have been the bane of Indian mining up to the present, and it is to be feared that in the future many an enterprise will be wrecked because it has met with unexpectedly good stone at its outset. Shareholders should bear in mind the fact that in Wales 9,363 ounces of gold were once obtained from 40 tons of quartz, and yet gold-mining in Wales has declined year by year until at present it can scarcely be said to have an existence at all.

But the fact of the reefs being poor is in some respects more encouraging than if they were very rich. This will appear paradoxical, but it is nevertheless true. In other countries the greatest quantity of gold has not been obtained from the veins which yield the largest amount per ton. In India the charateristic feature of the auriferous formations is that they cover a great tract of country. In the Dharwar Collectorate, throughout the Province of Mysore, in Salem, Coimbatore, and Malabar, on the Nilgiris, and in every part where gold has been found, the reefs are not solitary, but they are widely disseminated, and of great extent. If then, the gold can be extracted from them at a cost which pays, it is plain that the benefits to the population will be greater, the consequences to the country

more important, and the quantity of metal produced larger, than if the auriferous reefs were very rich, but confined to a limited area. And that it will soon be possible to extract the gold at a much lower cost than has been done heretofore cannot for a moment be doubted. It must be remembered that as a commercial industry the treatment of auriferous ores is very young, and that the methods even now in use are far from satisfactory. We have however arrived at an era when the richer fields being exhausted, men's efforts are being concentrated on the attainment of better and more exhaustive processes. Every week some new invention is now being brought forward, and although no one has yet succeeded in producing a perfect gold-saving apparatus, yet the steps made in that direction induce the hope that ere long the appliances in use will at any rate be very much improved. The recent discovery that an electrical current will prevent mercury from sickening, and enable it to pick out the gold from any mass of impurities, is one from which very important results may follow.

Given improved methods in the mining of the ore and more perfect means of extracting the gold from it, there is a probability that in Southern India the other factors of success will be readily obtainable. We have any number of labourers well-fitted for working underground, and who in time, under proper direction, would make capital miners. We have a superabundant supply of educated natives seeking for remunerative employment, who with special education in metallurgy, would be well-fitted for carrying out the processes of reduction. We have a manufacturing population which is one of the readiest in the whole world in recognizing a demand for any particular supplies, and straightway competing to furnish them at a low cost. We are able to import machinery and mining plant free of all duties. And lastly, we are in comparatively close proximity to a country where gold-mining has been carried on with the greatest success, and whence we can obtain at starting the teachings of many years.

A remarkable fact is that what we are most wanting in is

work of superintending labour in a mine is, it might be thought, one for which Eurasians are especially fitted, and we have here a large class of Eurasians seeking employment at very moderate wages. Yet the attempts to make use of Eurasians in the mines have hitherto resulted in failure; the men are generally willing enough, but they lack the judgment requisite for superintending blasting operations, and they have not the qualities necessary for encouraging the coolies to persevere in difficult and dangerous work. In consequence it has often been found more economical to employ Cornishmen, or Australians, on very much higher wages. The explanation however is that the men have not been taken young enough; to make good workmen they must be brought up to the employment; they must be bred at the mine, and begin by working the drill and pick with their own hands. In time they will make efficient bosses of shifts, while the more intelligent among them will rise to the positions of Captain, Millwright, and even Mine Manager. Schools of Mines in Madras or Bangalore would do little or no good; technical education is wanted, but if it is to be of any use it must be acquired at the mine.

That Government will do much for an industry which is in such disrepute is not to be expected, and if gold-mining ever succeeds in this country it will be all the better if it can exist without any fostering. What is needed is liberal encouragement to prospectors. This is passively afforded by the conditions on which land is now granted in Madras and Mysore. But it is a question whether the encouragement should not be more active by the obtainment of Diamond drills, which might be hired out by prospectors on terms similar to those in practice in the Australian colonies, and thus deep ground be tested at a moderate cost. To reckon the advantages to be obtained from the establishment of the industry would be out of place here, and not only so, but would be imitating the vicious example set by the company-promoters at home. On the other hand, it cannot be denied, that there is a class of officials which believes in no progress of any kind excepting what is laid down in official regulations; what is notified through the medium of the

Government Gazette. The miner is looked upon by them as an interloper, and mining as nothing better than a swindle. What future they look forward to for the country, it is impossible to say.

In almost all countries where gold-mining has been established as an industry, it has had first to pass through successive phases of failure. The first period is generally ushered in by the announcement of some grand discovery, a nugget of enormous dimensions, or a highly auriferous gully; then a rush ensues, and the surface soil is searched for treasure by numbers of men carrying on their work separately, or in parties of three or four. But it does not take long before the uppermost and easily accessible alluvial is exhausted, and then this phase comes to an end. With the second period commences the extraction of gold from its matrix, the quartz reef. Parties of men, a dozen or more in number, unite their capital, and buy sufficient machinery to enable them to break out the ore, and reduce it by crushing; they work generally with their own hands, and for a while their labour is successful. But after a time, difficulties are encountered; the reef perhaps is lost, and they have a flow of water to contend with; their means are too small to obtain the requisites for deep sinking, and so they in their turn fail. The third period is nearly always commenced with an ephemeral excitement. A report is circulated that mining on a large scale is certain of success, the report is exaggerated and garbled by speculators to serve their own ends; an unreasonable enthusiasm is raised, and capital is attracted in quantity; the commonest maxims of commercial wisdom and prudence are then ignored, and results are clamoured for with irrational impatience. The consequences are natural; the bubble companies soon collapse, and then there follows a fatuous disbelief in all the genuine speculations. This last phase of failure has almost invariably followed the preceding two. It was experienced in Victoria in 1862, and in New South Wales more recently; in South America in 1825, in the United States in 1864, and in Canada in 1869. And in every one of these countries after the collapse, mining enterprise has

appeared to be dead for a time. But the experience has not been thrown away; earnest men have persevered in places where there have previously been ignominious failures; bringing determination, foresight, and thrift to the task, they have first shown that profitable results were not unattainable, and then they have attracted capital back to the search; there has been a return of confidence, and the industry has been established on a secure basis, and prospered.

In India the first phase of failure happened ages ago, and the second is beyond the limit of human recollection; the history of the third is written in the pages of many an investor's banking account. It is possible that there may yet be a recovery. Dearly purchased experience is at our service; machinery (often still dearer) is procurable for a tithe of its cost. What has been proved in other countries may yet be demonstrated in this. It is more likely to be done without the aid of Home capital than with it, as Home capital will necessitate Home management, and will involve a large variety of Home interests. There may yet be many reverses, and the most serious of these will result from success. When the boom comes, the man who does not take advantage of it is either a fool or a fanatic; but a boom for all that is frequently a death-blow to a promising enterprise. That gold-mining as an industry will ever be raised above the level of a speculation, a gamble, is more than doubtful, but the stores of information on mining matters accumulated at the present time render it, under certain essential and natural conditions, a perfectly legitimate commercial pursuit. And if the science of economy in the management be studied, a pursuit which has as many rewards as most others.

In Southern India we have the benefit of researches made by two distinguished members of the Geological Survey*. The published results are within the reach of all, and as far as they go should be a guide to prospectors. It has been the practice here, as in many other countries, for the Miner to de-

* Records Geological Survey of India, Vol. VII, p. 133. Vol. VIII, p. 29. Vol. XI p. 235. Vol. XV p. 191.

preciate the teachings of the Geologist, but an intelligent following of the latter's investigations will sometimes save much useless expenditure. For instance, a retired circus-clown might tell people at home to look for gold on the Shevaroys, and be believed, but if he were to do so here, it is possible that we might suspect that he was trying on a somewhat larger scale the merry jests, which in his palmy days, he used to practise with such marked success on the master of the ring. The unhealthy excitement of 1880 and 1881 has not been altogether without advantage. It has stimulated a search for localities where mining may be tried with reasonable hope of making profits from the gold obtained. The lessons of the past three years have not been altogether thrown away. Already, in several districts operations have been commenced on conditions which justify the expectation that success will be achieved. Whether that expectation will be realized or not, time alone can show.

LIST OF THE EXISTING

INDIAN GOLD MINING COMPANIES,

(Compiled from information contained in the prospectuses of the different companies, reports of meetings, the *Stock Exchange Year-book*, the *South of India Observer*, and other sources.)

SOUTH WYNAAD DISTRICT.

Cootacovil Gold Mining Company, Limited.—*Office:* 32, Great St. Helen's, E. C. *Directors:* W. R. Arbuthnot, C. Tottenham, J. J. L. Labouchere, and H. Tolputt, (*Managing Director*). Registered 16th June 1881. *Bankers:* Consolidated Bank. *Solicitors:* Oehme and Summerhays, Gresham House, E. C. *Capital:* £100,000 in £1 shares; of which £83,002 is paid, 32,010 vendors' shares being fully paid, and the remainder having 15*s.* paid. *Price of Property:* £60,000; £32,010 being taken in shares. *Extent of Property:* 300 acres. *Favorably reported on* by C. J. Harvey. The property consists of Cootacovil Hill on the Charlotte Estate of the TAMBRACHERRY COMPANY (of which this Company is an offshoot) with lands adjoining; the tenure is freehold. The mill consists of two batteries of 10 stamps each, driven by a 15 inch Turbine; regular crushings have not yet commenced. *Manager*: C. Moon. The ordinary shares are quoted in the official list. The accounts are made up to 30th June and submitted in November.

Ripon Gold Mining Company, Limited.—*Office:* 8, Tamarind Lane, Bombay. *Directors:* Dinshaw Manockjee Petit (*Chairman*), Ahmedbhoy Hubibbhoy, E. B. Carroll, F. A. Little, Raghoonath Narayen Khote, Pooranchund Panalal, C. H. B. Forbes. Registered in August 1880. *Secretaries and Agents:* C. H. B. Forbes and Co. *Agents at Calicut:* Peirce Leslie and Co. *Bankers:* Bank of Bombay. *Solicitors:* Cleveland Little and Nicholson. *Capital:* Rs. 4,00,000, of which Rs. 1,79,800 is called, 10,000 vendors' shares of Rs. 100 each being fully paid, and the remainder 29,910 shares of Rs. 10 each having Rs. 8 called, of which Rs. 59,480 is unpaid. *Price of Property:* Rs. 1,00,000, in shares. *Extent*

of Property: 200 acres. The property consists of a block of land four miles to the east of the town of Meypady. Three reefs distinguished as Nos. 1, 2, and 3, are being worked by shafts and adits. The mill consists of a battery of 30 heads, driven by a horizontal 25 H. P. engine. *Manager*, R. Hill. The last accounts were made up to 31st July 1882 and submitted in October.

Tambracherry Estates and Wynaad Gold Mining Company, Limited.—*Office:* 32, Great St. Helen's, E. C. *Directors:* W. R. Arbuthnot, J. J. L. Labouchere, C. Tottenham, and H. Tolputt (*Managing Director*). Registered on the 10th February 1881. *Bankers:* London Joint Stock Bank. *Solicitors:* Oehme and Summerhays, Gresham House, E. C. *Capital:* £160,000 in £1 shares, fully paid. *Price of Property:* £120,000; £52,000 taken in shares. *Extent of Property:* 5,700 acres. *Favorably reported on* by C. J. Harvey and T. Laing. The property consists of six estates situate in South Wynaad, formerly the property of the TAMBRACHERRY COFFEE COMPANY. Little or nothing is being done in mining, the company depending on its coffee, cinchona, tea, and India-rubber for its future profits. *Superintendent*, J. Jewett. In June 1881, a portion of the property, called Cootacovil Hill was sold to the COOTACOVIL GOLD MINING COMPANY, LIMITED, for £60,000 and a dividend of 10 per cent. was paid out of the proceeds of the sale; the Company also holds £32,010 in shares of the Cootacovil Company. The Company is quoted in the official list. The accounts are made up annually to 30th April, and submitted in August.

Wynaad Gold Mining Company, Limited.—*Office:* 8, Tamarind Lane, Bombay. *Directors:* Major C. H. Strutt, Raghoonath Narayen Khote and C. H. B. Forbes. Registered in September 1880. *Secretaries and Agents:* C. H. B. Forbes and Co. *Bankers:* National Bank of India. *Solicitors:* Craigie Lynch and Owen. *Capital:* Rs. 6,50,000, in Rs. 25 shares; of which Rs. 2,75,972 is paid, 6,000 vendors' shares being fully paid, and 6,000 shares being reserved and the remainder, 14,010 shares having Rs. 22½ called, of which Rs. 39,253 is unpaid. *Price of Property:* Rs. 3,00,000; Rs. 1,50,000 being taken in shares. *Extent of Property:* about 1,000 acres. *Favorably reported on* by W. Vazie Simons. The property consists of the *Hump* Estate, and is situate about 8 miles from the top of the Tambracherry Ghaut. Several reefs have been opened out, but no machinery has been erected, and work is suspended in the meanwhile. *Manager*, G. L. Yonge. The last accounts were made up to 31st July 1882, and submitted in October.

ROUTE.—Rail or steamer to Beypore; bullock-coach to Calicut (7 m); country-cart to Poodoopady (17 m), and up the Tambrachery ghaut to Vythery (11 m).

SOUTH-EAST WYNAAD DISTRICT.

Devala-Moyar Gold Mining Company, Limited.—*Office:* 2, Great Winchester Street, E. C. *Directors:* Major-Gen. A Light, *(Chairman,)* P. Carnegy, W. Baxter, and W. Hodding. *Secretary:* A. N. Frewer. Registered 18th June 1880. *Bankers:* National Bank of India. *Solicitors:* Lattey and Hart, 16 Devonshire Square E. C. *Capital:* £200,000 in £1 share, fully paid. *Price of Property:* £132,000; £61,795 being taken in shares. *Extent of Property:* 2,055 acres. *Favorably reported on* by R. Brough Smyth and Oliver Pegler. The property consists of the following estates, which formerly belonged to the MOYAR COFFEE COMPANY, situated near Devala, South-East Wynaad. *Strathearn* and *Maryland* freehold, *Wright's land* held under a grant from Mr. Alexander Wright for 68 years from 1st March 1873; no rent payable, and such rights as the *Moyar Company* has; *Harewood* and *Kintail* on lease from the Rajah of Nilamboor, the former for 99 years from 1854 at a rent of Rs. 300 per annum, and the latter for 28 years from 1862, and renewable at a rent of Rs. 60 per annum. Mining rights on *Harewood* and *Kintail* conferred by the Rajah of Nilamboor, over any 20 acres thereof to be selected at a royalty of Rs. 25 per annum per acre, with a proviso that any additional land required for mining may be obtained, if applied for within the next five years. Work is being done on the *Strathearn* and *Salomon's* reefs, and the mill is completed. *Manager*, W. Gitchell. This Company in December 1880 sold 50 acres to the RHODES REEF COMPANY for the sum of £130,000, £50,000 being taken in shares; by this sale the shareholders received a dividend of 5*s.* per share and one share in the RHODES REEF COMPANY for every four shares held. The Company is quoted in the official list. The accounts are made up annually to 30th September and submitted in December.

Devalah—Central Gold Mines Company, Limited.—*Office:* 2, Crown Buildings, 70, Queen Victoria Street, E.C. *Directors:* H. Wright, *(Chairman,)* T. J. Bewick, A. F. Brown, L. C. Probyn, H. D. H. Fergusson. *Secretary:* E. J. Honychurch. Registered, 27th October 1880. *Bankers:* Imperial Bank. *Solicitors:* John Shaw, 48, Bedford Row, and Fowler and Co., 3, Victoria Street, Westminster. *Capital:* £100,000 in £1 shares fully paid. *Price of Property:* £70,000; £20,000 being taken in shares. *Extent of Property:* 986 acres. *Favorably reported on* by R. Brough Smyth and Oliver Pegler. The property consists of the *Hamslade*, *Hamsluck*, *Adelphi*, and *Nadoogany* estates situated in Devala, South-East Wynaad. The three first named estates are held under lease from the Rajah of Nilamboor for 99 years from 1854 at a rental of Rs. 500 per

annum. The mining rights for 36 years from August 1879, with agreement as to renewal; they extend over any 20 acres to be selected within the boundaries of the property at an annual rental of Rs. 25 per acre, with the stipulation on the part of the lessor to grant any additional acreage required for mining on the same terms if applied for within five years. The *Nadoogany* Estate is held under lease for 48 years from March 1875, at an annual rental of Rs. 500. The Mining rights on this estate are secured under a separate lease for 36 years from August 1879, with agreement as to renewal; they extend over 5 acres at an annual rental of Rs. 25 per acre, with a similar stipulation as to additional acreage. The *Hamsluck* reef is being worked. The mill-site is in a low flat, the battery is to be driven by water-power. *Manager*, C. T. Rowe. The Company is quoted in the official list. The accounts are made up annually to 31st December and submitted in May.

Indian Consolidated Gold Mining Company, Limited.—*Office:* 9, New Broad Street, E. C. *Directors:* Major-General W. Agnew, J. S. Campbell, A. J. Lambert, M. Low, T. G. Gillespie. *Secretary:* S Grady. Registered, 11th June 1881. *Bankers:* Union Bank of London. *Solicitors:* Lyne and Holman, 6, Great Winchester Street, E. C. *Capital:* £400,000 in £1 shares fully paid. *Price of Property:* £275,000; £130,000 being taken in shares. *Extent of Property:* 1,920 acres. *Favorably reported on* by Oliver Pegler. The property consists of the surface and mining rights of the six estates of *Dunbar, Sheardale, Palmerston, Henrietta, Balcarres* No. 1, and *Balcarres* No. 2, situate in South-East Wynaad; the mining rights are for 48 years. A number of reefs are being opened out, of which No. 5 *Balcarres* is said to be the most promising. One of the terms of sale was that the vendors should place crushing plant on the ground; this condition has been carried out by the erection of six Elephant stamps driven by steam-power. *Superintendent,* Colonel Henderson. The Company is quoted in the official list. The accounts are made up to 31st December, and submitted the following December.

Indian Glenrock Gold Mining Company, Limited.—*Offices:* Dashwood House, 9, New Broad Street, E. C. *Directors:* S. L. Howard, Lieut.-General E. Wray, C. B., R. P. Harding, J. T. Hopwood, Sir J. Humphreys, T. G. Gillespie. *Secretary:* S. Jennings. Registered 26th February 1880, and in 1882 was amalgamated with the SOUTH INDIAN GOLD MINING COMPANY, LIMITED. *Bankers:* London and County Bank. *Solicitors:* Ashurst Morris Crisp and Co., 6, Old Jewry, E. C. *Capital:* £240,000 in £1 shares fully paid. *Price of Property:* £97,000; £33,000 taken in shares. *Extent of Property:* 4,200 acres. *Favorably reported on* by C. J. Harvey. The property consists of the *Glenrock* and other Estates near Pundaloor in South-East Wynaad comprising the mining rights. The *Mango, Koorumber,* and *Bittusal* reefs are being

worked by tunnels. The mill consists of 20 heads of stamps driven by a 14 inch, 35 H. P. Turbine. *Manager*, A. E. Pinchin. The Company is quoted in the official list. The accounts are made up to 31st March, and submitted in July. In April 1882 deferred certificates were issued to the then shareholders entitling them to a payment of 4*s*. per share out of "profits which may at some future time accrue from sales of land belonging to the Company."

Indian Gold Mines Company, Limited.—*Offices:* 139, Vincent Street, Glasgow. *Directors:* J. C. Cunningham, *(Chairman,)* W. Anderson, Rev. Dr. F. L. Robertson, A. Russell, J. Wilson, (Glasgow) J. Wilson (Edinburgh.) *Secretary:* T. A. Craig. Registered on 22nd April, 1879, to take over certain properties from estates involved with the City of Glasgow Bank failure. The articles of association provide that the profits up to £50,000 shall belong solely to the Company, that after that they shall be equally divided between the Company and the vendors until the total amount so divided reaches £4,000,000, that thereafter 50 per cent. of the profits shall go to the Company, 20 to the vendors, and 30 to the liquidators of the City of Glasgow Bank on behalf of the contributories; this scale to continue until such liquidators have received £5,000,000, and thereafter the profits are to be equally divided between the Company and the vendors. *Capital:* £110,000 in £10 shares; £81,322 is paid up; 5,732 shares being fully paid, and 4,910 having £5 called. The property consists of the whole area from the western boundary of the *Alpha* Estate to the eastern boundary of the *Bear* Estate, excepting about 40 acres; with unrestricted mining and surface rights in every part. The Company is working the SOUTHERN INDIA ALPHA mine and the property of the PRINCE OF WALES' PROSPECTING COMPANY, including the *Skull* reef and *Wrights'* level. A battery to be driven by water-power is in course of erection. *Manager,* ————————. The accounts are made up to 22nd April and submitted in July.

Indian Phœnix Gold Mining Company, Limited.—*Offices:* 6½, Austin Friars, E.C. *Directors:* Major-General W. Agnew, L. V. Helms, A. J. Lambert, J. D. Pender, Lieutenant-General E. Wray, C. B. *Secretary:* A. W. Rixon. Registered on 12th October 1880. *Bankers:* Imperial Bank. *Solicitors:* Stebbard Gibson & Co., 21, Leadenhall Street, E. C. *Capital:* £150,000, in £1 shares fully paid. *Price of Property:* £85,000; £33,000 taken in shares. *Extent of Property* 800 acres. No special report on it published. The property comprises four estates held under leases at nominal rents free of all royalties, the *Phœnix, Lytton, Rosedell,* and *St. Thomé;* it adjoins the property of the INDIAN GLENROCK COMPANY, and is situate near the town of Pundalur in South-East Wynaad. The *Agnew* and *Cobra* reefs on the *Phœnix* estate are being worked; the former is opened out in three places, known as the Agnew, Gifford, and Grove sections. The battery consists of 20 heads driven

by a 14 inch, 40 H. P. Turbine. *Manager*, W. Grove. The Company is quoted in the official list. The accounts are made up to 31st December and submitted in May.

Indian Trevelyan Gold Mining Company, Limited.—*Offices:* Dashwood House, 9, New Broad Street, E.C. *Directors:* J. S. Campbell, J. T. Hopwood, S. L. Howard, M. Low. *Secretary:* H. Lyon. Registered, 3rd February 1881. *Bankers:* Union Bank of London. *Solicitors:* Lyne and Holman, 5, Great Winchester Street, E. C. *Capital:* £150,000 in £1 shares fully paid. *Price of Property:* £96,000; £50,000 taken in shares. *Extent of property:* 930 acres. *Favorably reported on* by R. Brough Smyth. The property consists of the surface and mining rights of the *Trevelyan* Estate, and of the mining rights of the *Attikunmoo* and *Limerick* Estates, formerly the properties of the SOUTH INDIAN COMPANY. The DEVALA-MOYAR COMPANY'S Estates form the chief southern boundary. The *Strathearn* reef runs into the property. *Manager*, W. James. The Company is quoted in the official list. The accounts are made up annually to 31st December and submitted in May.

Pandi River Gold-Washing Company, Limited.—*Offices:* 7, Great Winchester Street, E.C. *Directors:* J. M. Chapman, L. Chapman, Hon. J. M. F. Erskine, J. G. Glen, and N. Phillips. *(Managing) Secretary:* F. Wisdom. Registered, 15th April 1882. *Capital:* £30,000 in £1 shares fully paid.

Rhodes Reef Gold Mining Company, Limited—*Offices:* 2, Great Winchester Street, E.C. *Directors:* Major-General A. Light, R. H. A., *(Chairman,)* P. Carnegy, C.I.E. W. Baxter, W. Hodding. *Secretary*, A. N. Frewer. Registered, 9th November 1880. *Bankers:* National Bank of India. *Solicitors:* Lattey and Hart, 16 Devonshire Square, Bishopsgate Street, E.C. *Capital:* £190,000 in £1 shares fully paid. *Price of Property:* £130,000; £50,000 taken in shares. *Extent of Property:* 50 acres. *Favorably reported on* by R. Brough Smyth. The property is of freehold tenure and therefore free from all rent, royalties, or renewal fees; the land is 25 chains as near as possible in the direction of the outcrop, and 20 chains in breadth. Worked by the same staff as the DEVALA-MOYAR Mine, *Manager*, W. Gitchell. The vendors were the DEVALA-MOYAR COMPANY. The Company is quoted in the official list. The accounts are made up to 31st December and submitted in June.

South-East Wynaad Estates, and Gold Mining Company, Limited.—*Offices:* 1, Queen Victoria Street, E.C. *Directors:* H. P. Stone, *(Chairman,)* M. R. Evans, S. H. Hewitt, A. Hall, R. J. Laing, C. E. *Secretary:* W. H. Thompson. Registered, 28th January 1880. *Bankers:* Imperial Bank and Agra Bank. *Solicitors:* Newman, Stretton, and Hilliard, 75, Cornhill, E.C. *Capital:* £100,000 in £1 shares fully paid. *Price of property:* £60,000. *Extent of property:* 3,000 acres. *Favorably*

reported on by R. Brough Smith. The property consists of the *Needlerock*, *Bolingbroke*, *Richmond*, *Elizabeth*, and *Downham* estates, situated in South-East Wynaad; all surface and mining rights are secured, subject to no deduction. The *Elizabeth* and *Downham* reefs have been opened out. The Mill at the former consists of a 12-stamp battery driven by steam power. *Manager*, J. J. Cooper. The Company is quoted in the official list. The accounts are made up annually to 31st May.

South Indian Gold Mining Company, Limited, now amalgamated with the INDIAN GLENROCK GOLD MINING COMPANY, LIMITED.

Southern India Alpha Gold Mining Company, Limited.—*Offices:* 4, The Sanctuary, Westminster. *Directors:* A. F. Brown, (*Chairman:*) Lieut.-Col. F. Bolton, W. de Caux, J. Dodds, M.P., Lord C. J. Hamilton, M.P., L. C. Probyn, and J. Shaw. *Secretary*: P. Scratchley. Registered, May 1874, under the Indian Companies Act of 1866. *Capital:* Rs. 6,00,000 (of which Rs. 3,76,850 is subscribed) in shares of Rs. 50, (transferable in London): Rs. 2,41,485 is paid up; 4,056 shares being fully paid, 2,341 shares having Rs. 15 paid, and 1,140 shares having Rs. 3 paid. In addition to the paid-up capital as above ranking for dividend, there are 2,000 founders' bonds of Rs. 50 each, which entitle the holders thereof to the payment of that amount without interest, after payment to the shareholders of dividends and bonus equal to the whole paid-up capital of the company, and 10 per cent interest thereon. The mines are being worked by the INDIAN GOLD MINES COMPANY, LIMITED, under agreement entered into in November 1880. By this agreement the Glasgow Company undertake the working and development of the Alpha Company's Mines supplying all the machinery and plant. For this the Glasgow Company are to be allowed as working cost, the actual expenditure not in excess of 3 dwts. of gold produced per ton of quartz crushed, and the produce of the gold after providing for these expenses, to be divided equally between the two companies so long as the average production is 12 dwts. per ton or under—when the production exceeds 12 dwts. per ton, the whole of the proceeds are to be divided equally without any deduction by the Glasgow Company for working cost. The accounts are made up annually to 30th April, and submitted in July.

Wentworth Gold Mining and Indian Estates Company, Limited.—*Offices:* 34, Nicholas Lane, E.C. *Directors:* H. W. Maynard, W. Graham, E. N. Binney, R. Ewing, and H. T. Stanes. *Secretary:* C. Frewer. Registered on the 2nd June 1881. *Bankers:* Martin & Co. and Agra Bank. *Solicitors:* Harwood and Stephenson, 31, Lombard Street, E.C. *Capital:* £120,000 in £1 shares, of which £40,000 vendors' shares are fully paid, and £80,000 have 15 *s.* per share paid. *Price of Property:* £80,000; £40,000 taken in shares. *Extent of Property:* 2,027 acres. *Favorably reported on* by Oliver Pegler. The property consists of

the following estates situate in South-East Wynaad. *Wentworth, Cherambadi, Llewellyn, Kanambyle, Chanthanam,* and *Barbrick.* The mining rights are granted in perpetuity; the surface is under leases and subleases for unexpired terms, having nearly sixty years to run, at nominal yearly rents, and subject to the payment of a cultivation tax to the Indian Government, altogether not exceeding £150 per annum. The mining operations so far have been merely tentative; the company looks forward to a large income from the cultivation of cinchona; its coffee estates are leased for £2,000 per annum.—*Manager:* J. Ryan. The accounts are made up annually to 30th September.

ROUTE.—Rail or Steamer to Beypore; boat to Eddiwuna (53 m.); country-cart to Yeddicarra (14 m.) and up the Carcoor Ghaut to Nadgany toll-bar (7 m.) The more usual route is by rail to Mettapollium; tonga to Ootacamund (34 m.); tonga to Neddiwuttum (21 m.); thence to Gudalur (11 m.); thence to Devala (8 m.); thence to Pundalur (3¾ m.)

KOLAR DISTRICT.

Balaghat Gold Mining Company, Limited.—*Office:* 1, Bentinck's Buildings, Madras. *Directors:* Sir W. Arbuthnot, E. Barclay, A. Mackenzie, S. R. Turnbull. Registered in December 1880. *Secretaries and Treasurers:* Arbuthnot & Co. *Solicitors:* Barclay and Morgan. *Capital:* Rs. 3,60,000, in Rs. 1,200 shares. *Price of Property:* Rs. 1,20,000; Rs. 60,000 taken in shares. *Extent of Property:* 150 acres. No special report was published. The property is the most northerly of the blocks in Kolar; it has been opened out by a series of shafts sunk on the main line of reefs; the battery consists of an Elephant stamp. *Manager,* Thomas Bray. The last accounts were made up to 30th June 1882 and submitted in July.

Colar Gold Mining Company, Limited.—*Office*; 20, Cockspur Street, S.W. *Directors:* Colonel A. W. C. Lindsay. *Chairman:* G. V. Agnew, A. H. Anderson, Major-General J. T. Harris, and W. D. Ryrie. *Secretary:* W. H. Beaumont. Registered 16th August 1880, but not issued until 15th October 1880. *Bankers:* London Joint Stock Bank. *Solicitors:* Simpson and Curlingford, 85, Gracechurch Steeet, E.C. *Capital:* £150,000, in £1 shares; first issue £75,000 of which £62,500 is paid up, 25,000 vendors' shares being fully paid, and the remainder having 15*s.* paid. *Price of Property:* £40,000; £25,000 being taken in shares. *Extent of Property:* 320 acres. *Favorably reported on* by the Directors "who are personally acquainted with the district." The property is in the Kolar district, adjoining the land of the MYSORE COMPANY on the North, and of the GREAT SOUTHERN COMPANY (in liq.) on the South. *Manager,* T. Roach. No regular crushings have commenced, the company's object now being to sink deep. The ordinary shares are quoted in the official list. The accounts are made up to 31st October and submitted in January.

Kaiser-i-Hind Gold Mining Company, Limited.—*Office:* 8, Tamarind Lane, Bombay. *Directors:* Major C. H. Strutt, E. B. Carroll, R. Valentine Reid, C. H. B. Forbes. Registered 28th December 1880. *Secretaries and Treasurers:* C. H. B. Forbes and Co. *Bankers:* Chartered Mercantile Bank. *Solicitors:* Craigie Lynch and Owen. *Capital:* Rs. 12,00,000, in Rs. 25 shares, of which Rs. 5,67,685 is paid; 15,000 vendors' shares being fully paid; 6,000 shares being reserved, and the remainder 27,000 shares being fully called, but Rs. 1,07,315 being unpaid. *Price of Property:* Rs. 7,50,000; Rs. 3,75,000 taken in shares. *Extent of Property:* about 640 acres. *Favorably reported on* by John Harris. Work has been suspended for some months.

Nine Reefs Gold Mining Company, Limited.—*Office:* 38, Lombard Street, E.C. *Directors:* Colonel G. B. Malleson, C. S. I. (*Chairman*), J. T. Lawrence, W. McCandlish, C. E., and Captain W. B. McTaggart, *Secretary:* C. F. Tombs. Registered on 30th March 1881. *Capital:* £91,500, in £1 shares, of which £75,728 is paid up, 49,442 shares being fully paid, and the remainder having 12*s.* 6*d.* paid. *Price of Property:* £60,000; £30,000 taken in shares. *Extent of Property:* 300 acres. *Favorably reported on* by John Harris. The property lies at the Northern end of the Kolar field, adjacent to the *Balaghat* block. Mining rights for 30 years on the usual conditions. Mining explorations have been carried on for some time, and no crushing plant has be erected. *Manager:* T. Johns. Has a settlement on the Stock Exchange, but no quotation.

Nundydroog Gold Mining Company, Limited.—*Office:* 6, Queen Street Place, E.C. *Directors:* Captain W. B. McTaggart (*Chairman*), H. D. H. Fergusson, G. S. Kennedy, R. Taylor, J. Taylor, and O. Webb. *Managers:* J. Taylor and Sons. *Secretary:* W. G. Williams. Registered on 6th November 1880. *Capital:* £76,929, in £1 shares, fully paid. *Price of Property:* £50,000; £33,000 taken in shares. *Extent of Property:* 320 acres. *Favorably reported on* by John Rogers, The property adjoins the *Ooregum* mine on the North, and is between it and the *Balaghat* property, working on the same line of reefs. Its battery consists of Elephant stamps. Work is suspended at present. *Manager:* B. D. Plummer. The accounts are made up annually to 31st December and submitted in June. Has a settlement on the Stock Exchange, but no quotation.

Ooregum Gold Mining Company, Limited.—*Office:* 2, George Street. Mansion House, E.C. *Directors:* M. Low (*Chairman*), Colonel C. S. Blair, W. G. Probyn, and General J. Travers. *Secretary:* T. W. Martin, Registered on 25th October 1880. *Capital:* £125,000 in £1 shares fully paid. *Price of Property:* £75,000; £20,000 taken in shares. *Extent of Property:* 256 acres. *Favorably reported on* by W. Vazie Simons. The *Maharaja* reef has been opened out at a depth of 120 feet. The Battery consists of 20 heads driven by steam power; regular crushings have commenced. *Manager:* W. Eddy. The accounts are made up to 31st May. The Company is quoted in the official list.

ROUTE.—Rail to Colar Road; country-cart to field (7 m).

Mysore Gold Mining Company, Limited.—*Office:* 6, Queen Street Place, E.C. *Directors:* C. Tennant, M. P. *(Chairman)*, O. Webb, J. Hunter Blair, R. Henty, Capt. W. B. McTaggart, A. S. Schaw, J. Taylor, and R. H. Taylor. *Managers:* J. Taylor & Sons. *Secretary:* W. G. Williams. Registered, 6th July 1880. *Bankers:* Union Bank of Scotland. *Solicitors:* Francis and Johnson, 22, Austin Friars, E.C. *Capital:* £135,000, in £1 shares fully paid. *Price of Property:* £55,000. *Extent of Property:* 750 acres. *Favorably reported on* by W. Bell Davies. The property is situate between the *Ooregum* and *Colar* blocks; the present object of the Company is to sink deep shafts in the search for payable stone. *Manager:* S. Tonkin. The Company is quoted in the official list. The accounts are made up to 31st August and submitted in December.

NILGIRI DISTRICT.

Illathoray Gold Mining Company.—No information is procurable regarding the origin of this Company. Its land runs in a wedge shape inside the *Mountain Glen* estate near Kotagiri, and the reef it is working is a continuation of *Kay's*. It has erected a battery, driven by an overshot water-wheel, and has commenced crushing, and produced 24 oz. 18 dwts. of gold, largely alloyed with silver. *Superintendent.* W. R. Moore.

Kotaghiri District Estate and Gold Mining Company, Limited.—*Office:* Ootacamund. Registered in March 1881. Eight share-holders. *Capital:* Rs. 3,30,000 in Rs. 1,000 shares; of which Rs. 53,862-13-2 has been called. Property consists of the *Mountain Glen* and *Hardathoray* estates 11 miles from Coonoor, and 4 miles from Kotagiri. Has two reefs, *Kay's* and *Ogden*, the latter of which has been partially opened up.

ROUTE.—Rail to Mettapollium; tonga to Kotagiri (20 m.)

HONNALI DISTRICT.

Honnali Gold Mining Company, Limited.—*Office:* 13, Errabauloo Chetty Street, Madras. *General Managers:* Wilson and Co. Registered on 10th October 1882. *Capital:* Rs, 4,00,000 in Rs. 100 shares, of which Rs. 2,60,000 is paid up; 2,000 vendors' shares being fully paid, and the remainder having Rs. 30 paid. *Price of Property:* Rs. 2,00,000 in shares. *Extent of Property:* 420 acres. *Favorably reported on* by Henry Prideaux. *Turnbull* and *Smith* reefs are being opened up by shafts. A battery of 10 heads is in course of erection. *Manager:* Thomas Weekley. After half the working capital has been called up, there is to be a meeting of the holders of ordinary shares to decide whether work is to be continued, or the Company to be wound up. The accounts are made up to 30th September, and submitted in October.

ROUTE.—Rail to Bangalore; bullock-coach, with posted bullocks, to Nyamti (191 m.) viâ Tumkur, Tiptur, Kadur, and Shimoga. The journey by road occupies about four days.

ALPHABETICAL LIST OF DIRECTORS

OF

INDIAN GOLD MINING COMPANIES.

Agnew, Mr. G. Vans	Colar.
Agnew, Maj.-Genl. W.	Phœnix, and Consolidated.
Ahmedbhoy Habibbhoy	Ripon.
Anderson, Mr. William	Indian Gold Mines.
Anderson, Mr. A. H.	Colar.
Arbuthnot, Sir William	Balaghat.
Arbuthnot, Mr. W. R.	Tambracherry, and Cootacovil.
Baxter, Mr. William	Devala-Moyar, and Rhodes Reef.
Bewick, Mr. Thomas J.	Devalah-Central.
Binney, Mr. E. N.	Wentworth.
Blair, Mr. J. Hunter	Mysore.
Bolton, Col. F.	Alpha.
Brown, Mr. A. Forrester	Devalah-Central, and Alpha.
Campbell, Mr. John Scarlett	Consolidated, and Trevelyan.
Carnegy, Mr. Patrick	Devala-Moyar, and Rhodes Reef.
Carroll, Mr. E. B.	Ripon, and Kaiser-i-Hind.
Chapman, Mr. J. M.	Pandi River.
Cunninghame, Mr. J. C.	Indian Gold Mines.
De Caux, Mr. W.	Alpha.
Dinshaw Manockjee Petit	Ripon.
Dodds, Mr. J., M. P.	Alpha.
Erskine, Hon. J. M. F.	Pandi River.
Evans, Mr. M. R	South-East Wynaad.
Ewing, Mr. Robert	Wentworth.
Forbes, Mr. C. H. B.	Ripon, Wynaad, and Kaiser-i-Hind.
Fergusson, Mr. H. D. H.	Devalah-Central, and Nundydroog.
Forbes, Mr. C. H. B.	Wynaad, Ripon, and Kaiser-i-Hind.
Gillespie, Mr. T. G.	Consolidated, and Glenrock.
Glen, Mr. J. Grey	Pandi River.
Graham, Mr. William	Wentworth.
Hall, Mr. Arthur	South-East Wynaad, and Perseverance.
Hamilton, Lord C. J., M. P.	Alpha.
Harding, Mr. R. P.	Glenrock.
Harris, Maj.-Genl. J. T.	Colar.
Helms, Mr. L. V.	Phœnix.
Henty, Mr. R.	Mysore.
Hewitt, Mr. S. H.	South-East Wynaad.

Hodding, Mr. W.	Devala-Moyar, and Rhodes Reef.
Hopwood, Mr. J. T.	Glenrock, and Trevelyan.
Howard, Mr. S. L.	Glenrock, and Trevelyan.
Humphreys, Sir John	Glenrock.
Kennedy, Mr. J. L.	Nundydroog.
Labouchere, Mr. J. J. L.	Cootacovil, and Tambracherry.
Laing, Mr. R. J.	South-East Wynaad, and Perseverance.
Lamb, Mr. Henry	Perseverance,
Lambert, Mr. A. J.	Consolidated, and Phœnix.
Lawrence, Mr. John T.	Nine Reefs.
Light, Maj.-Genl. Alfred	Devala-Moyar, and Rhodes Reef.
Little, Mr. F. A.	Ripon.
Lindsay, Col. A. W. C.	Colar.
Low, Mr. Malcolm	Consolidated, Trevelyan, and Ooregum.
Malleson, Col. G. B.	Nine Reefs.
Maynard, Mr. H. W.	Wentworth.
Mackenzie, A.	Balaghat.
Mc'Candlish, Mr. William	Nine Reefs.
Mc'Taggart, Capt. W. B.	Mysore, Nine Reefs, and Nundydroog.
Pender, Mr. J. D.	Phœnix,
Phillips, Mr. N.	Pandi River.
Pooranchund Panalal	Ripon.
Probyn, Mr. L. C.	Devalah-Central, and Alpha.
Probyn, Mr. W. G.	Ooregum.
Raghoonath Narayen Khote	Ripon, and Wynaad.
Reid, Mr. R. Valentine	Kaiser-i-Hind.
Robertson, Rev. Dr. F. L.	Indian Gold Mines.
Russell, Mr. A.	Indian Gold Mines.
Ryrie, Mr. W. D.	Colar.
Schaw, Mr. A. S.	Mysore.
Shaw, Mr. John	Alpha.
Stanes, Mr. H. G.	Wentworth.
Stone, Mr. H. Palmer	South-East Wynaad, and Perseverance.
Strutt, Maj. C. H.	Wynaad, and Kaiser-i-Hind.
Taylor, Mr. John, Jun :	Nundydroog, and Mysore.
Taylor, Mr. Richard	Nundydroog.
Taylor, Mr. R. H.	Mysore.
Tennant, Mr. C., M. P.	Mysore.
Tolputt, Mr. Henry	Cootacovil, and Tambracherry.
Tottenham, Mr. C.	Cootacovil, and Tambracherry.
Turnbull, Mr. S. R.	Balaghat.
Webb, Mr. O.	Mysore, and Nundydroog.
Wilson, Mr. John (Edinburgh)	Indian Gold Mines.
Wilson, Mr. John (Glasgow)	Indian Gold Mines.
Wray, Lt.-Genl. E. B.	Glenrock, and Phœnix.
Wright, Mr. Henry	Devalah-Central.

RULES FOR THE GRANT OF GOLD MINING LEASES

ON

GOVERNMENT LANDS IN THE MADRAS PRESIDENCY.

Persons desirous of obtaining permission to mine for *gold* or for *metals other than gold* on waste land the property of Government should apply for a mining lease to the Collector of the District, specifying distinctly the situation of the land within which it is proposed to mine and its boundaries as accurately as can be stated, together with its estimated area. Every application should be accompanied by a rough sketch of the tract applied for, or the approximate position of the lot required be marked on the Survey plan. When the application is for permission to mine for *gold*, the limit of such lot shall not exceed 150 acres; the breadth of each lot shall not be less than 70 yards. In the case of applications to mine for *metals other than gold*, the extent of such lot shall not exceed half a square mile. Applications will be dealt with in order of receipt by the Collector. On an application being accepted by the Collector, the lot or lots will be durably demarcated and surveyed at the cost of the applicant, to whom a lease in the prescribed form will be granted on the following conditions:—

(1) that the lease shall be for a term not exceeding twenty years;

(2) that an annual rent of Rs. 5 *per acre* or portion of an acre in the case of a lease to mine for *gold* and of *Rs. 2. per Acre* or portion of an acre in the case of a lease to mine for *metals other than gold* shall be payable in arrears by equal half-yearly instalments, the first payment to be made at the expiration of six months from the date of the execution of the lease;

(3) that if, in the course of mining operations under a lease to mine for metals other than gold, the lessee find any gold exceeding the proportion of 2½ dwts. per ton of quartz crushed, he shall report the same to the Collector and accept a lease to mine for gold for the residue of the term in lieu of the lease to mine for metals other than gold;

(4) that the lessee will, within nine months from the execution of the lease, commence operations and thereafter, during its currency, in the best and most effectual manner and without intermission, except when prevented by inevitable accident, carry on mining operations, and will, whenever called upon, furnish proof of his having done so;

(5) that the lessee shall pay the value, as fixed by the Collector or other officer authorized by him in that behalf, of all timber and other trees standing on the land leased.

(6) that the lessee shall be liable to forfeiture on failure to observe any of the conditions specified in the lease, the Governor in Council being the final arbiter as to whether the conditions of the lease have been duly observed or not;

(7) that the lease shall be renewable at the lessee's option on such terms as the Governor in Council for the time being may settle, at the expiration of the original lease;

(8) that during the term of the original lease, there shall be no liability to any royalty or other tax in addition to the rent specified in Clause 2, except in accordance with the provisions of the Local Fund Act, No. 4 of 1871 (Madras) or any similar law for the time being in force, and with the further exception of any taxation which may hereafter be found necessary to provide, at the expense of the lessee, the cost of such special police, communications, water-supply, sanitation or other similar administrative arrangements as may, in the opinion of Government, be dictated in the interests of the local community immediately or directly affected by the results of the lessee's operations.

Without the written permission of the Collector previously obtained, the land applied for must not be entered upon, nor operations commenced.

No lessee of any block leased under these rules for mining purposes shall divert any road, path or bye-way on the block leased, or any water-course beyond the limits of the block leased to him, and all water running waste on such block shall be returned to its natural channel within the limits of the same block.

Failure to observe this condition will render the lease liable to forfeiture.

The foregoing conditions will be equally binding on the transferree in case the lease is transferred.

RULES FOR THE GRANT OF MINING LEASES

IN THE

MYSORE TERRITORIES.

I. Each lease will be limited to a block not exceeding one square mile in area, and will be given for a term of 30 years according to priority of application. Applications for more than one block from the same applicant will be taken into consideration if there are no other applicants, and if no other objection exists.

II. The lessee is to make his own arrangements with the holders of Government occupied assessed and inam lands in regard to entering upon or obtaining possession of them.

III. The lessee is to pay to Government the annual assessment, as now existing or as hereafter revised by any survey, on all the arable lands, occupied or waste, and the jodi or quit-rent on any inam lands, as well as an assessment of eight annas per acre on all the unarable lands which may be included within the limits of the lease, together with all local cesses and other taxes or rates of every description, payable in respect of the premises or lands comprised in the block, or of buildings or works erected thereon.

IV. The lessee is to pay a royalty of 5 per cent. on the gross proceeds of all gold, metallic ores, coal and other substances of a merchantable nature, which shall have been dressed, crushed and made merchantable, and of 10 per cent. on the saleable value of all precious stones found in the selected block, clear of all deductions whatever.

V. The lessee is to search and mine for gold, &c., throughout the term of the lease in the best and most effectual manner without intermission except when prevented by inevitable accident. But after the expiry of the first two years of the lease, the Government reserves to itself the option of levying in lieu of the royalty an assessment of 5 Rupees per acre in the event of its not being satisfied with the working or its results for any years of the lease.

VI. The lessee is required to keep regular accounts and plans and maps of the mines and workings, which are to be open to inspection by Government officers.

VII. Government officers are authorized to inspect and examine the mines.

VIII. The lessee is to keep all boundary posts in good order, and to fence every shaft, pit or open working.

IX. The lessee is not wilfully to close, fill up or choke any mine or shaft without permission, and not to obstruct any existing roads, paths or bye-ways on the land.

X. The Government are authorized to recover any arrears of rent by distraint and sale of property belonging to the lessee, and in the event of the breach of any of the covenants on the part of the lessee, or of his causing any annoyance or obstruction to any class of persons or Government officials, the Government can cancel the lease on due notice and in default of satisfactory explanation within six months.

XI. In the event of the lessee not desiring a renewal of the lease on such terms as the Government may fix, he will be bound to deliver the land to Government at the expiration of his lease, with the shafts and other premises in good repair and working order together with the books, maps and plans, free of any claim on account of buildings or other property left standing on the lands. And he should permit the purchase by Government of the buildings, plant, machinery and fittings at a fair valuation.

XII. Any arrangement for commuting the royalty by a present payment of a lump sum as is sanctioned to the Kolar Concessionaires will be specially considered in each case; but the Government does not undertake to allow such commutation necessarily in every case; nor to grant every application for a lease as a matter of course.

XIII. No lease will be granted until the applicant deposits a sum of Rs. 1,000 as a security for the proper fulfilment of the engagement.

A GLOSSARY OF MINING TERMS.

[Compiled from glossaries in Brough Smyth's and Lock's books, from the *Mining World*, and other sources.]

ADIT.—A nearly horizontal passage from the surface, by which a mine is entered and unwatered. In the United States an adit is usually called a tunnel, though the latter, strictly speaking, passes entirely through a hill and is open at both ends.

AIR-STACK.—A stack or chimney built over a shaft for ventilation.

ALLUVIAL.—Characterizing soils and drifts deposited by aqueous agencies now or recently operative.

ALLUVIUM.—The soils, sands, quartz-drifts, clays, and auriferous gravels of recent formation found in the lines of drainage.

AMALGAM.—The compound of mercury with gold or silver.

AMALGAMATION.—The process of effecting the compound of mercury with gold or silver.

AMALGAMATING BARREL.—A common barrel with an axle through the longer axis; it is charged with the pyrites, &c., caught in the blankets, and a proportionate quantity of quicksilver; by revolving it amalgamation is produced.

ARASTRA.—A fixed round iron pan in which mineral is ground by means of heavy stones or pieces of iron being dragged round by an axle revolving in the centre.

ASSAY.—The testing of ores by chemical or blow-pipe examination. An assay differs from a complete analysis in being confined to the determination of certain ingredients, the rest not being determined. It may be qualitative or quantitative.

ATTLE.—Refuse. *See* MULLOCK.

BACK.—The upper portion of old quartz workings where the reef has been left unworked. The roof of a drive or stope, or the hanging-wall of a reef. The ground between any level and the surface.

BACKING.—A piece of timber laid across a drive near the roof, each end fitted into hitches cut in the rock with slabs or laths placed between it and the roof.

BALANCE-BOB.—The compensating weight attached to the beam of a pumping engine.

BAR.—A stratum differing in hardness or direction from the surrounding strata.

BARREL QUARTZ.—Quartz having a corrugated form.

BATTERY.—A set of stamps.

BEARERS.—Pieces of timber placed in the shaft as foundations for sets of timber at certain intervals.

BED-ROCK.—The solid hard rock underlying loose and incoherent strata.

BENCH.—A terrace on the side of a river, and having at one time formed its bank. *See* REEF-WASH.

BIT.—The steeled point of a borer or drill.

BLACK SAND.—The black and heavy minerals which usually accompany gold.

BLANKET-TABLE.—An inclined table covered with green baize, and placed at the end of a ripple-board to catch the fine gold, pyrites, &c.

BLAST-HOLES.—Holes bored for blasting. The perforations at the bottom of the windbore.

BLIND-CREEK.—A line of drainage in which water flows only during very wet weather.

BLIND-SHAFT.—*See* WINZE.

BONANZA.—An aggregation of rich ore in a mine. (American.)

BOB-PIT.—The excavation in which the balance-box attached to the pump-rods works.

BORE-HOLE.—A hole bored either for blasting, or for ascertaining the character of the strata.

BORER.—*See* DRILL.

BOTTOM.—*See* BED-ROCK.

BOTTOM-LIFT.—The deepest column of a set of pumps.

BOXING.—A method of securing shafts solely by slabs.

BRACE.—The mouth or collar of a shaft. *See* MAIN-BRACE.

BRANCH.—A small vein departing from the main-lode; in some cases returning.

BRATTICE.—A wall of separation. A wooden partition in drives to secure ventilation.

BREASTING.—Timber used in levels driven in very soft ground, and placed across the drive behind the inside set of timber.

BRECCIA.—Angular fragments composing a rock or vein.

BROWNSTONE.—Decomposed iron pyrites—(Australian).

BUCKSTONE.—Non-auriferous rock (Australian).

BUDDLES.—Machines for separating pyrites from tailings; somewhat similar in construction to puddling mills.

CAGE.—A frame with one or more platforms for cars, used for hoisting in a vertical shaft.

CALCINING.—Roasting quartz for the purpose of decomposing the pyrites.

CAM.—A curved tongue employed to raise the stamp, and then allow it to fall by its own gravity on the substance to be crushed.

CAM-SHAFT.—The revolving axle on which the cams are fixed.

CAP.—The upper portion of a reef. The piece of timber which is placed over the props in a drive.

CAPTAIN.—The official in immediate charge of mining operations (Cornish.) *See* UNDERGROUND MANAGER.

CASING.—Material found between a reef and its walls.

CATCH-PIT.—An oblong pit used for catching and storing the water and tailings run off from a crushing machine.

CEMENT.—A term very widely applied to all auriferous conglomerates.

CLACK.—A pump valve.

CLAYING-BAR.—A round bar of iron used to shut back the water from the bore-hole before introducing the charge of powder.

CLEAN-UP.—The operation of collecting all the valuable product of a given period or operation, in a stamp-mill.

COFFER.—The cast-iron box in which the stamp-heads work.

COLOUR.—Minute traces, or individual specks of gold.

CONCENTRATION.—The removal of the lighter and less valuable portions of ore.

CONGLOMERATE.—Agglutinated rounded quartz-gravel. Differs from breccia, which is always composed of angular fragments.

CONTOUR RACE.—A race following the contour of the country.

CORD OF FIREWOOD.—Measures 128 cubic feet, or more than two of the usual tons of firewood. It makes a pile, eight feet long, four feet high, and four feet broad.

COUNTRY.—The geological strata on each side of a vein.

CRADLE.—A long wooden box fixed on rockers, used for washing alluvial.

CREVICING.—Picking out the gold caught in cracks and crevices in the rocks over which it has been washed.

CROSS-COURSE.—An intersecting (usually a barren) vein.

CROSS-CUT.—A level driven at right angles to the direction of the strata or reef.

CUTTING DOWN A SHAFT.—Increasing its size.

DEADWORK.—Work that is not directly productive, though it may be necessary for exploration and future production.

DHONIE.—A wooden trough about 4 ft. long used by julgars in Mysore for washing alluvial. It corresponds to a cradle.

DIP.—The downward inclination of a reef; at right angles to the strike.

DISC.—The head secured to the stamp-stem by which the cam raises, and lets fall the stamp upon the substance to be crushed. American, TAPPET.

DOOR-PIECE.—That portion of a lift of pumps in which the clack or valve is situate. Access to the valve is got by unscrewing the door.

DOWNCAST.—The shaft through which air descends into a mine.

DRIFT.—A drive, level, or gallery.

DRIFTING.—Working a mine by tunnels.

DRIVE.—A level or gallery driven horizontally in the reef.

DROPPER.—A spur dropping into the lode; a feeder.

DROP-SHAFT.—A monkey-shaft, down which earth, or other matter, is lowered by means of a pulley. The empty bucket or truck is brought up as the full one is lowered.

DUCT-MACHINE.—An apparatus for forcing air into a mine.

DYKE.—A mass of intrusive rock, occurring in a manner somewhat similar to a vein.

ELVAN.—A Cornish term for felspathic rocks occurring in dykes.

ENGINE-SHAFT.—The main shaft in which the pumps are fixed; usually the deepest shaft in the mine.

FACE.—The end of a drive.

FALSE SET.—A small set of timber used to support the ground temporarily until the drives are so far advanced as to permit of the permanent sets being fixed.

FAN.—A machine for forcing air down a shaft or into a drive.

FAULT.—A dislocation of the strata, or the vein.

FEEDER.—A small vein joining a larger one.

FLOAT-GOLD.—Gold in tiny thin scales which float on running water.

FLOOR.—The bottom of a drive. A seam or joint in a rock.

FLOUR-GOLD.—The finest alluvial drift-gold.

FLOURING.—The coating of small particles of mercury with sulphides.

FLUCAN.—Clayey matter in the vein.

FOOT-HOLES.—Holes cut in the sides of shafts or winzes to enable miners to ascend or descend them.

FOOT-WALL.—The wall on the lower side of the vein.

FORK.—When a mine is in *fork*, the bottom of the engine-shaft is clear of water.

FOSSICKING.—Much the same thing as crevicing.

GALLERY.—A level or drift.

GOZZAN.—Oxide of iron and quartz usually found at the decomposed outcrop of mineral vein.

GASH-VEIN.—A wedge shaped vein.

GRATING.—The perforated metal sheet in front of the stamper-box.

GROUND-SILL.—That part of a drive-set of timber which is laid on the floor, and on which the legs of the set rest.

GROUND-SLUICE.—A channel into which the earth is conveyed by a stream of water.

GUIDES.—Continuous lengths of squared timber down the sides of the shaft, along which the cage travels. *See* SKIDS.

HALAGAY.—A circular wooden dish used by juglars in North Mysore.

HANGING-WALL.—The wall on the upper side of the reef. Sometimes called HEAD-WALL.

HEAVY-GOLD.—Gold in large particles.

HOPPER.—A wooden frame-work which receives the quartz that is to be crushed, and delivers it to the stamper-box.

HORSE.—A body of slate or sandstone inclosed within the quartz of a reef. Also an iron support to the cam-shaft of a Battery.

JIGGING.—Separating ores according to specific gravity with a sieve agitated up and down in water.

JULGAR.—A native gold-washer. The term is used principally in Mysore, but does not necessarily mean one who washes the alluvial; many julgars make a living by extracting the metal from the goldsmith's refuse.

JUMP-UP.—A short winze dug in the roof of a drive. *See* MONKEY-SHAFT.

KIBBLE.—An iron bucket used for raising quartz, lowering timber, &c., in the shaft.

KINDLY QUARTZ.—Quartz having the appearance of containing gold.

KNOCKER.—A hammer fixed near the mouth of a shaft, and pulled by a line hanging down the shaft; used as a medium of communication between men underground and those at the surface.

LEAD.—A well-defined bed of pay-dirt.

LEADER.—A small vein of quartz supposed to join the main lode.

LEG-PIECE.—The upright prop in a drive-set of timber.

LEVEL.—A horizontal passage in a mine.

LIFTER.—The iron bar on which the disc and stamp-head are fixed.

LIFT OF PUMPS.—A series of pipes consisting of wind-bore, or suction pipe; clack-piece in which the stationary valve is fixed; working barrel in which the pump bucket works; and a column reaching either to the cistern from which the next lift takes its water, or to the surface.

LONG-TOM.—A gold-washing machine about 24 ft. in length.

MAIN-BRACE.—The platform at the mouth of a shaft to which the trucks of auriferous dirt are removed from the cage. *See* BRACE.

MAIN-SHAFT.—*See* ENGINE-SHAFT.

MAKING.—The apparent re-formation of a reef.

MAN-HOLE.—An aperture in the ladder sollar for the passage of miners in ascending or descending a shaft by the ladder-way.

MIA-MIA.—A light shed erected over the mouth of a shaft.

MICE-EATEN QUARTZ.—Quartz with holes which were formerly occupied by crystals.

MONKEY-SHAFT.—A shaft rising from a lower to a higher level. A winze is sunk from a higher to a lower level.

MULLOCK.—Rubbish, dirt, &c.; the refuse after the vein stuff is removed.

MUNDIC.—Iron pyrites.

MURRYA.—A wooden dish used by native gold-washers in the Wynaad.

OPEN-CUTTING.—An excavation made for the purpose of getting a face, wherein a tunnel can be driven.

PANNING-OFF.—The process by which gold is separated from the gravel.

PASS.—An aperture left open in the workings, through which communication is held between the backs and the drives.

PILLAR.—A portion of the virgin ground left in mining to support the roof or wall.

PILLAR-DRIVE.—A wide irregular drive constructed in firm dry ground, without the use of timber; and in which the roof is supported by pillars of the natural earth.

PINCHED-OUT.—A reef is said to be pinched-out when it is wedge-shaped, or runs out.

PIT-WORK.—The pumps and other apparatus of the engine-shaft.

PITMAN.—The man who attends to the pumps and timber of the engine-shaft, and to the security of the permanent levels, &c.

PLAT.—A chamber or excavation made at the point of departure of a level from a shaft.

PLUGGING.—Forcing plugs of clay into holes to stop leakage.

PLUNGER.—The cylinder used to force water up a column of pumps.

POCKET.—A crevice either in the reef or in the bed-rock, containing gold.

POPPET-HEADS.—Cross pieces of timber above the mouth of a shaft, on which rest the axles of the pulleys which guide the ropes attached to the cages or buckets.

PROSPECT.—The yield of gold got from a dish of washdirt, or from roughly reduced quartz.

PUDDLING A SHAFT.—Ramming clay between the timber and the rock to dam back the water.

PUTTY.—A gold-washing tray used in the Wynaad.

QUARTZ-BOIL.—An outcrop, or an extension in the width of a reef.

RACE.—An artificial water course.

REEFING.—Working auriferous reefs or veins.

STAY.—A piece of timber laid across a shaft to maintain the pumps in a vertical position.

REEF-WASH.—A deposit of washdirt spread over an expanse of flat or undulating reef, or lodged in a hollow of the reef.

RETORTING.—Removing the quicksilver from an amalgam by volatilising it in an iron retort.

REVERBERATORY FURNACE.—A furnace in which ores are submitted to the action of flame without contact with the fuel. The flame enters from the side or end, passes upward over a low wall or bridge, strikes the roof of the furnace, and is reverberated downward upon the charge.

RIDER.—*See* HORSE.

RIFFLE OR RIPPLE.—A groove, 1 inch deep, and 3 inches wide, cut across the ripple-board and partly filled with quicksilver, over which the slum from the stamper-box flows.

RISE.—Work done in the back of a level. The upper portion of a stope. *See* JUMP-UP.

RUBBLY-REEF.—A vein much broken up.

SADDLE REEF.—A reef, the upper portion or cap of which has the appearance of an inverted V.

SET-OFF.—An iron projection from the main pumping-rod on which the bucket pumping rod is fixed.

SET OF TIMBER.—In a shaft consists of four pieces joined in a rectangular form to fit the sides of the shaft; generally fixed 5 feet apart. In a level, consists of four pieces, the ground-sill, two leg-pieces, and the cap piece; placed at distances varying from 4 to 6 feet and connected by slabs.

SHANK.—*See* LIFTER.

SHEARS.—*See* POPPET-HEADS.

SKIDS.—Wooden rails or guides on which sledges, trucks, buckets, or bags, slide or run.

SKID-SHAFT.—A shaft sunk more or less on the underlie, and in which the buckets slide between two wooden rails or skids.

SLABS.—Split pieces of timber from 4 to 6 feet long, 2 to 3 inches thick, and 7 to 14 inches wide, placed behind the sets of timber in shafts or levels.

SLIDE.—A vein of clay intersecting a quartz reef.

SLUICE-HEAD.—A definite measure of water drawn off for use.

SOLLAR.—A wooden platform fixed in a shaft as a rest for ladders, or for other purposes.

SPUR.—An irregular quartz vein.

STAMP.—In a broad signification embraces the disc, stamp-stem, stamp-head and the shoe which fits into the last mentioned.

STAMPER-BOX.—A box, generally of cast-iron in which the stamps work,

STOPING.—Working out the reef in steps; if this is done by working from below upwards it is called overhand stoping; if by excavations from above downwards, underhand stoping.

STRIKE.—The longditudinal direction of a reef. The dip is necessarily at right angles to the strike.

STUDDLE.—A piece of squared timber placed vertically between two sets of timber. Four studdles are commonly used, one in each corner of the shaft; but in large shafts six are sometimes used.

STULL.—Logs of wood laid across the workings at intervals of about 5 feet with an elevation to the hanging-wall of 50° or 75°.

SUMP.—The lowest portion of a shaft into which water from the workings flows.

TAILINGS.—The detrital mud flowing from gold-washing or crushing apparatus.

TAIL-RACE.—An acqueduct for conveying away dirty water and tailings.

UNDERLIE.—A mining term for dip.

WASH-DIRT.—Auriferous gravel, sand, clay, or cement.

WASHING-OFF.—Cleaning out the boxes, tables, blankets, &c.

WATER-LINE.—The line in any reef where water is struck in the several shafts.

WHIM-BUCKET.—*See* KIBBLE.

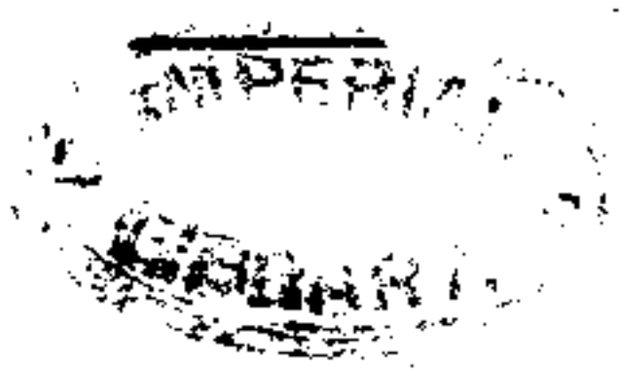
WINDBORE.—The bottom or suction pipe in a lift of pumps.

WINDSAIL.—The top part of a canvas piping, similar to what is used on steamers for the purposes of ventilation.

WINZE.—A small shaft sunk in the bottom of a level, or between two levels for ventilation, or for working the reef, or for communication.

UNDER-GROUND BOSS.—The superintendent of a shift or gang of miners.

UNDER-GROUND MANAGER.—The official in charge of mining operations under the direction of the mine manager.



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APPENDIX.

NOTES ON MINING AND MILLING.

Mining in Victoria in 1863.—Mining enterprise, so far as Melbourne capital is concerned, was dead when this inquiry was commenced. The mania which took possession of the public some two or three years ago had produced its natural fruits. The bubble companies first went, and the losses in which they involved their victims produced disbelief in those genuine speculations which were brought into existence about the same time. On every gold-field some Melbourne Company planted its foot, and built its machinery, and then—impatient in expectations of profit—withdrew the supplies, suspended labour, sold off for a tithe of their cost machinery and claims, which might have been made to contribute largely to the produce of gold, and the profits of the share-holders. One after another, promising speculations had dropped out of the list of existing Companies. *Bolivias*, *Monte Christos*, *Reforms*, *Fortunas*, *Old Quartz Hills*, and *Eaglehawks* had melted away in rapid and ruinous succession. Chairmen and directors had vanished from the scene. Secretaries, whose most arduous task seemed to be the daily perambulation of Collins-street, gloved in lemon-kid and spotless in attire, had transferred their talents to distant spheres. Of the brokers who crowded the share exchange a year before, only a few were left—the substantial men of their race—while scores had thrown a sea change between them and Melbourne. Their old familiar places in the long room of the Criterion, at the hour of lunch, knew them no more. But though dead for the time, it was seen to be impossible that mining enterprise, in a colony so promising as Victoria, so rich in metals, and so abundant in unemployed capital, could long remain without showing symptoms of revival. Some stimulus in this direction was given by the great yields of gold obtained on Ballarat. The slow but certain progress of some of the Maldon Companies, the extraordinary results obtained by the Ajax and other semi-private adventures in mines where public companies had ignominiously failed, had given a breath of air to fan the slowly-reviving flame, to which the splendid promise of the new fields about the Jordan appeared likely to give fresh life and vigour. But there seemed to be a danger that if the same causes were left to operate as they had done before, the same results would follow. New schemes, as gilded and as hollow as those disposed of in the past, would arise, to dazzle and to burn those who were tempted by them ; stock-jobbing would displace legitimate investment, and that spirit of enterprise which, fairly exercised and turned into proper channels, might be productive of lasting benefit to the colony, would waste itself in vain labours, and leave mining, as a great colonial interest, in a worst position than it was before.—*The Gold fields of Victoria in* 1862.

Gold Reef Problems.—With some exceptions the gold obtained in New South Wales has been from the alluvial drifts, while in the neighbouring colony the quartz reefs have been the greatest and most permanent source of wealth. Alluvial mining after all cannot last long, though it may be exceptionally rich while it does. Quartz reefs on the other hand, give work for a practically unlimited period, and furnish extensive and ready employment and consequently are of greater value to a country than alluvial. The question has often been asked why two countries so adjacent as New South Wales and Victoria should manifest such differences in

gold mining, why the reefs in the former should be fewer and less prominent than in the latter. It is true that the geological characteristics of the two countries somewhat differ, at least a portion of New South Wales is very diverse to Victoria. The great difference lies in the fact that in that Victoria and Queensland seem to have found the reefs, the matrices from whence came the alluvial gold, in New South Wales they have not been discovered in the majority of the old alluvial fields. Various theories have been held as to the source of alluvial gold, but experience in the different great reefing districts of Australia has led to the adoption of a maxim by all practical miners: "Where alluvial gold has been found, there will gold-bearings be discovered." Practical reefers hold to this theory, and if great deserted alluvial fields are instanced as showing its falsity, the answer is that the reefs exist, but that they have yet to be found, and to this no reply can be made. Experience has also demonstrated two remarkable facts that have been noticed on several fields. It has been found that where the gullies have been very rich in alluvial, the reefs found near the surface on the hills have not yielded a high percentage to the ton, while if the gullies were poor, the neighbouring reefs have been extremely rich. Many instances could be given. The reason advanced by practical men is very feasible. They hold the theory that alluvial gold is deposited in the gullies by the forces of nature—air, water, and chemical action decomposing the quartz reefs, which are gradually exposed to the action of these forces by the wearing away of the rocks which enclose them. Where the 'cap' or "blow" as it is variously called—it must be confessed that, after all, we know but little of the laws governing the deposition of gold—has been worn away, and the metal lodged in the water course, it is not to be expected the remnant of the reef near the surface will be rich. Where, on the contrary, much of the upper reef remains, rich yields will follow. The rule, of course has its exceptions. There are two kinds of reef—the saddle, and the single—though in reality the difference is but of degree, the former having walls wide apart, the latter narrow walls. Saddle reefs occur in regular succession from the surface, lying one below the other, with 'legs' running off into the walls on each side. In some cases where the 'cap' or 'horse' of the saddle has been washed away into the gullies by the work of ages, the 'legs' have been mistaken for the real reef, and the resulting disappointment has often caused the abandonment of what has afterwards been found valuable country. The single reefs run right down from the surface and are generally thin and enclosed in hard walls. They usually yield a higher average than the saddle reef, and to pay they must, for the expenses are greater. In Victoria saddle reefs are the more numerous; in New South Wales the single reefs have, so far, been in the majority. Practical reefers find if reefs are poor on the surface, and the "country" much disturbed, that when the secondary and tertiary saddle reefs are reached, or the single reefs are worked in the deep ground, a change for the better takes place. And practical men with large experience doubt very much whether in many cases what are called "single" reefs are not in reality the legs of decomposed saddle reefs. Whether such is the case or not remains yet to be proved, and the expenditure of money and deep sinking will not alone solve the problem. These theories generally refer to what may be called fairly regular formations. There are in New South Wales granitic and other formations in which gold has been found that so far defy any speculation or theory, and about which little or nothing is known. There is an influence which must not be lost sight of, for it is of great importance, that of the basaltic overflows, which have in many instances acted as gold cradles, or gutterers of gold. Given an old water course in which for countless ages has been deposited the gold that laid in the rocks worn down by the agencies of nature. A crater breaks out, and the

lava forces along the wash-dirt, and as it were cradles it as it rushes against the sandstone or granite walls. Hence, owing to this action, very often the richest wash-dirt is found under basalt, as at Mount Jones, or on the Rocky River. It has been discovered at Ballarat, where mining is carefully studied, that not only is wash-dirt found under the basalt, but that rich reefs exist beneath it. There is a great deal in this. At Ballarat practical men noticed that the leads in Sebastopol grew richer at certain places instead of obeying the law that as leads extend further from the hills where the quartz reefs which fed them were they grew poorer and the gold lighter, the weightier gold of course remaining near its matrix. These men argued from this that other matrices, other quartz reefs, occurred in the rocks under the basalt, and fed the lead as it went on. They were scoffed at then, but time has shown they were right, for the *Band and Albion* found a rich reef under their alluvial working, and have demonstrated the great fact that below the basaltic plateau of Ballarat, so rich in alluvial wash, lay a great reefing country—in fact that there was a Sandhurst under Ballarat. These undoubted facts should weigh with our miners in dealing with the many problems that must yet be solved before the quartz reefs of New South Wales are properly developed. Where are the reefs that have fed our alluvial gutters, or rather, where are the lower formations of these lodes? That is the question which has to be answered, and to which we should give attention. In the case of the Rocky River gold field it is remarkable that the rich deposits have occurred only between Uralla and Maitland Point, and have mainly been confined to where the basaltic Mounts Jones and Welch were heaved up against the primitive rocks. Do reefs lie underneath, or are we to look elsewhere for them? for that they exist admits, we hardly think of doubt. Practical work will alone solve these problems, for geology seems but a poor guide in gold-mining, and our Government does little to help the miner, while the disrepute into which reefing has temporarily fallen through ignorant mining and mere bubble mining, keeps away the capital necessary to work out the solution.—*Sydney Paper, December* 1882.

The Mines of Gilpin County, Colorado.—In the summary for the past year (1882) of the mining operations on the rich gold belt of Gilpin County, as published by the *Daily Register Call*, Central City, are a series of authentic accounts and statistics of the leading mines of the district, which augurs well for the continued prosperity of this prolific gold field, the total yield for the year being given as $2,006,516. It says "The vast wealth that is hidden away in the bowels of these white-capped mountains is simply beyond computation. The extent of it may not be known for centuries, and probably not then. As the earth is removed, the more valuable becomes the ore, and astounding its extent. The capitalists of the old world are beginning to see that there are millions in it and their agents are constantly appearing in our midst and securing titles to the best mines and mining property. Across the sea, 3 and 4 per cent. is considered a handsome profit for the use of money, and millions of it is loaned at those figures. The men who own it now see that they can invest it in mines that pay from 25 to 100, and even 500 per cent., and sometimes more than that. Many of our best mines are owned and operated by men who never saw them and were never in this country. They are operated by faithful and trusty agents. There are 27 stamp-mills in the district, with a total number of 987 stamps. The *Gunnell Consolidated* Company owns a series of mines, in all 7,055 feet patented property. Prior to 1874 the bullion output on those properties was $2,500,000, and since then up to the end of the year the yield of gold has been $1,270,735. The *California* mine is called the king of all the group of mines on Quartz Hill, and has proved one of the most profitable of any

in Gilpin County. Since the present company came into possession of this mine a large amount of substantial work and improvements in machinery and appliances have been effected, requiring considerable time and a large outlay of capital. Miners were put into the mine in August last, since then the following developments have been made :—Drifts, 1,040 ft., winzes sunk, 246 ft.; fathoms of ground removed 657; giving 5,390 tons of ore, leaving an average value of $12-65 per ton. The *British American* Company is starting a four-mile tunnel to cut through a series of mountains intersected with gold veins, including the celebrated Quartz Hill, at a depth of 1500 to 2500 feet; this when completed will be a grand mining enterprise. The capital stock is $1,000,000, of which $250,000 will be absorbed in payment for the right of way, mines, mill site, and stamp-mill, to operate on ores from the veins intercepted by the tunnel, leaving $750,000 for the construction of the work. The Bonanza and Union tunnels are two of the most important enterprises in the county. The present heading of the Bonanza tunnel is in 1109 feet from its mouth and has intersected 15 veins on which 1500 feet of drifting has already been done. The Union tunnel has been driven under Casto Mountain 626 feet cutting through six veins, on which over 500 feet of drifting has been done. A rich body of ore has been lately discovered in the south crevice of the Maryland vein, in one place 25 feet wide, the mineral assaying $84 to $198 per ton. Both tunnels are being driven ahead, although not by power drills, the Company waiting the arrival of two new boilers of the capacity of 50 horse power when Ingersoll's drills will be used; no stoping is being done on any of the veins crossed by either tunnel.

The Genesis of Ore deposits.—The mode in which mineral veins were formed has long been an interesting subject of investigation among those engaged about mines, and the question is now very fully discussed in a monograph by Mr. Rudolf Keck of Denver, Colorado, and a critical article upon it by Dr. Rossiter W. Raymond, published in the *New York Engineering and Mining Journal.* Revelations previously unanticipated in Geology, were, says Mr. Keck, made 30 years ago by chemists, and more recently the microscope has led to a complete revolution in petrography. But a few years ago, Professor F. Sandberger, at the University at Wurzburg, Bavaria, himself a practical mining engineer, arrived at the conclusion and followed it out, that substances which occur together in such close connection as vein-material and ores must logically have a similar origin. He separated the constituent silicates of rock (for instance mica) and analysed them in much larger quantities than those generally used for analysis. The results were and still are quite astonishing. With the exception of tellurium, gold, and mercury, for which he could not get proper material for analysis, all the chemical elements occurring in ore veins have been detected in those silicates, undoubtedly demonstrating that not only the ingredients of the gangue, but also those of the ores, are contained in the eruptive rocks which often are the wall-rocks of veins, or occur in their vicinity. A further result of his laborious researches is the proof that these metallic contents are found in the silicates of crystalline rocks of all geological periods. We find ourselves, he continues, forced to believe in a casual connection between eruptive rocks and ore deposits, when in the light of Professor Sandberger's researches, we study the aspect of volcanic rocks and the transmutations they undergo subsequently to their first consolidation, by weathering, by exhalations of sulphuretted hydrogen, muriatic acid, and other gaseous emanations, by which they are converted from a hard to a soft clayey state, or are bleached and become porous, fissile, or honeycombed, until at length they crumble into a siliceous powder; when we observe the massive segregations of ores in eruptive rocks; when we take into consideration that those mountainous regions in which eruptive rocks are wanting contain the least ore deposits,

and that the ore deposits occur more frequently in older than in the recent rocks, and are more common at the junction of various kinds of rocks than in the midst of large districts of a uniform rock; and that they usually occur in the latter case, only in case the rock is metamorphosed.

The entire material of all sedimentary rocks has been derived from the destruction and decomposition of former ones; thus it can be traced back to the region in our earth's crust from which the eruptive rocks were and are still arising. The Archæan rocks are among those of all sedimentary periods, the richest in ores, not only because they show the mightiest development, but also because they have been longest exposed to volcanic and chemical activity. "They are the only universal formation, they extend over the whole Globe, and were the floor of the ocean and the material of all emerged land when life first began to exist." In these rocks we have to acknowledge the visible origin of certain ores which we find, now-a-days, as secondary products in higher geological horizons. The fact that all minerals occurring in ore deposits could have originated in aqueous solutions; the drusy or combed texture of some ore deposits; the occurrence of minerals together with fragments of the wall-rocks in veins, a part of which appears to have been disintegrated by the action of water and friction; the omnipresence of water above and in our earth, especially during former geological periods; the absence of all indications of former intense heat within the ore deposits; the pseudomorphoses and other mineralogical phenomena; all these circumstances indicate that water was, and still is, the main agent in the mineralising process. All subterranean movements that produce joints and fractures in rocks, and the chemical action of the water circulating in our earth's crust, have given origin and peculiarities to ore deposits. In many cases it is evident that the origin of an ore deposit commenced with a more or less empty fissure caused by subterranean movements; but, in many other cases, this cannot be shown.

In explanation of the change of the silicates of metals contained in the eruptive rocks into sulphides, Mr. Keck states that the meteoric water on the surface of our earth carries free oxygen, nitrogen and carbonic acid. Penetrating the upper parts of the earth, which are rich in decaying organic matter, the free oxygen produces carbonic acid which is absorbed by the water; but this, on its way downward, takes up still more carbonic acid, which rises from the interior, and carries down also some organic substances, which reduce the sulphates of metals to sulphides. In this way the water effects the decomposition of a great many minerals by solution and precipitation. The results are carbonates, sulphates, sulphides, and silicic acid—becoming quartz afterwards—while the less soluble part mostly remains as silicates of alumina (clay) and magnesia (talc). The microscope has revealed the existence in abundance of minute cavities in eruptive rocks, in which water and salt, compressed carbonic acid, and sulphates are enclosed so hermetically that the water does not escape even when strongly heated. These substances are primitive constituents of such rocks, as well as the silicates. Therefore it is probable that there were some of these substances present during the eruptions of the rock, especially also sulphuretted hydrogen, as we observe them during volcanic eruptions now-a-days. The same gas is produced by means of organic matter reducing the sulphates of alkalis to sulphides, which change the salts of metals to those of sulphides. Organic matter, however, still occurs in many veins, and Mr. Keck considers that it is an evident fact that in many mines the quantity and richness of the ores depend on the occurrence of organic matter, which is only the remains of larger quantities of it, present in a state of decay in former times. To this day sulphuretted hydrogen is very common among the gas exhalations found on and in our

earth, and is easily absorbed by the circulating waters therein. But if that organic matter did not contain more or less sulphur, it could not, therefore, produce much sulphuretted hydrogen; and hence, in regard to ore-building, those sediments were more favorable which contained the remains of animal bodies; for instance, the upper bed of the blue limestone at Leadville. As the ultimate result of the leaching and crystallising process are found the different minerals constituting the gangue. Many dissimilar so-called vein formations are in the main, but formations of different leaching periods.

The books only say that the fissures had been filled by mineral springs; but they do not tell how. There are many mineral springs carrying free carbonic acid, sulphates, sulphuretted hydrogen, or organic matter, arising from the selvages of ore veins, using the latter like other fissures as their shortest way to the surface of our earth. Hence the conclusion was drawn that a casual connection may exist between these springs and the minerals in the vein. But Professor Sandberger had several times opportunities to pump out such springs, and to examine the fissures through which the springs were ascending; he never found a single trace of a sediment on the walls, although they cause large sediments of minerals on the surface where the air has access. Those springs, says Mr. Keck, have never caused the formation of a mineral vein; they have only carried off from them; but they cause precipitation and fixation of the precipitated sulphides, by filtering through a material offering a great surface. The miner has not very often to do with regular fissure veins, he rather has to take out his ores from more or less decomposed zones of rock containing ore segregations, or crossed by numerous little fractures filled with ores. The circumstances under which ore deposits came into existence were manifest for physical and chemical reasons; but the process of ore deposition in itself was always the same. If a fissure strikes through different kinds of rock, it may contain their different leaching products. The same may be the case where fissures cross each other. In such instances a remarkable change in regard to the quality and quantity of ore may be observed, and mostly a favorable change, because not only greater quantities, but also different characters of solutions met at such points; therefore the chances for a denser precipitation and segregation were greater. It is well known that the same vein within the same wall-rocks may show a very different distribution of ores. This may be explained partly by the configuration of the footwall, forming synclinals and anticlinals (the former having a favorable, the latter an unfavorable influence on the deposition of ore); partly by the other irregularities in the fissure and on the wall-rocks; partly by dykes crossing the veins and checking the speed of the solutions; and partly by the different, and more or less numerous affluxes from the wall-rocks to the fissure. In this respect ore chimneys and ore pockets may be mentioned.

As we have to take it for granted that the metals contained in veins were principally contained as silicates in the eruptive rocks, as the chemical and physical process of ore deposition always was the same, and as the water penetrates all kinds of fractures and cavities, it will always be a useless attempt to establish classes of ore deposits. He cannot see any other essential distinction between the ore deposits than in the manner of their origin, either in consequence of fissures caused by subterranean movements, or without fissures, merely by solution, removal and replacement of the material of their wall-rocks. Thus we may divide ore deposits into three main classes:—1. Fissure veins; 2. Veins of replacement; 3. Secondary deposits having been derived from former deposits of segregations. The latter distinguish themselves from the other two classes, by not shewing periodical segregations of quartz, ores and spars. To these belong for instance the ore beds deposited

in the sedimentary formation also the lead ore deposits of the Upper Mississippi, and at Raibl in the Austrian Alps, and the quicksilver deposits in California. Statistics show that the greater part of the mining in the world is done in the deposits belonging to the last two classes, not in fissure veins. It is strange to find in this country so much prejudice in favor of the fissure veins. The time will come when our successors will be enabled by the sum of certain coincidences of geological conditions to predict the presence of certain ore deposits. It will arrive so much the earlier, the more our Mining Engineers take pains to elaborate and publish monographs on mines and mining districts, and accompany them with correct maps and with statements furnished by competent analytical chemists and microscopists.—*Mining Journal.*

The Qwist-Leigh process of treating of Pyrites.—There are four kinds of pyrites, whose tenacity for the gold which they are known to contain is so great as to prove in some cases an almost insurmountable obstacle to the thoroughly successful working of certain mines. The pyrites alluded to may be ranged as copper pyrites, iron pyrites, blende or zinc pyrites and arsenical pyrites, the prefix in each case indicating the metal which predominates. In the majority of gold working one or other of these pyrites is to be found very abundant, and in some cases they are found to be very rich in chemically bound gold. There is a variety of ways of treating these refractory ores; but whatever process has hitherto been adopted in the colonies has always been found vexatious, inasmuch as the yield of gold has been altogether out of proportion to what was shown by the assay.

The Qwist-Leigh process for extracting gold from Pyrites is as follows. Three furnaces are built upon the reverberatory principle. They consist of a roasting or calcining furnace, a smelting furnace, and a cupelling furnace. The first of these is supplied with two hoppers at the top, and with two openings in the hearth for withdrawing the pyrites after it has undergone the first of a series of transformations. This furnace is about 23 feet long over all and 10 feet wide and is capable of receiving for treatment about a ton of pyrites. The second furnace, that in which the smelting is done, is subject to the most severe test, and is that upon which the success of the operation to a large extent depends. This furnace has a peculiarly designed hearth with an impenetrable bottom, but it is so constructed that the metal is drawn off at the bottom; the furnace is 18 feet long and 10 feet wide. The next department is a small house close by, called the assay-house and which is fitted up with a cupelling furnace; this furnace is supplied with a movable test and a fan-blast. The pyrites is introduced into the calcining furnace by the hoppers and subjected to a cherry red heat for about eight hours. All but a very small percentage of the sulphur is destroyed, and all the noxious gases, antimony, arsenic, and the usual matrix found in refractory auriferous quartz are oxidised. The pyrites having been transformed into a mass of clear calcined sand, which still retains whatever precious metals are in it, is discharged by the aperture at the bottom of the furnace. A test is then applied to determine the constituents of the calcined sand, and then certain fluxes are added. What these fluxes are is one of the secrets of the inventor. The calcined sand and flux are introduced into the smelting furnace and subjected to a most intense heat. Much greater, it is said, than is employed in glass-works—for eight hours. When the mass has become highly liquified the slag is discharged by a tap-hole in the side of the furnace. All the slag having been run off, the metals are drawn from a separate tap-hole which is situated at the bottom of the furnace. The metals, which are combined, are drawn into moulds, and the ingots thus formed are introduced into the

cupelling furnace. Before the metals are introduced into the cupelling furnace an assay is made, and it is this assay which shows whether the operation will be a thorough success or not; the result of this assay should correspond with that made when the pyrites was received at the works. As the lead becomes oxidised it is blown off at intervals by the fan-blast as a litharge. All that remains in the test when the operation has been completed is the gold, which is allowed to cool and is then withdrawn. The cupelling operation occupies between four and five hours, so that the operators are employed for about twenty hours before the gold is deprived of all the admixtures which cling to it prior to being manipulated. It is claimed that the process is economical, and that it withdraws from all kinds of pyrites every atom of gold.—*Mining Journal.*

Wurtz's Method of treating Pyrites.—An improved process for treating pyrites and sulphurets in the preparation therefrom of sulphuric acid, metals and metallic compounds, has been invented by Dr. Henry Wurtz of New York. The invention is especially and directly applicable to minerals composed of sulphur combined with iron or copper, or with both these metals together, including common yellow iron pyrites or marcasite, magnetic pyrites or pyrrhotine, or mixtures of any of these, or mixtures of these with other minerals or ores when such sulphurets occur in a pulverulent, comminuted, or granular state, whether found naturally in such granular state, or as reduced incidentally to such state by handling or transportation, or when pulverised by artificial means either purposely or incidentally, as in the case of concentrated sulphurets or tailings from ore-milling operations.

The first step in the process consists in mingling with such pulverulent or granular sulphurets, metallic iron, also in granular or comminuted state, and moistening the mixture with a saline solution which will cause the iron to rust, and thus cement the granules together in a coherent mass; the second in aiding and accelerating the rusting of the iron in such mixture, and thus hastening the consolidation thereof by an alternating application of heat moisture; the third, in incorporating with such mixtures fibrous and foliated mineral substances, such as asbestos and mica, which add to the cohesion of the mass before burning and preventing crumbling in the kiln, and in the subsequent handling of the cinders or residues; the fourth in the use in this process of the so-called "iron sponge," or iron in the comminuted form that results from the deoxidation of previously pulverised heated iron oxides by heated carbon, or by hot deoxidising gases; and the last in crushing the metallic sulphurets to granular condition when required, and removing the gangue and impurities by means of a current of air or water, or otherwise, and then recementing the purified granules together into masses by the rusting of comminuted metallic iron mingled therewith.

Mining in Sandhurst in 1882.—It is nearly three decades since Bendigo ventured upon the work of quartz mining, yet we are only of late learning from experience how mines should be worked so as to impart confidence, and obtain a decent profit upon operations. In proof of this permit me to submit a brief abstract of the results of our operations in the Sandhurst district in 1882.

Dr.	Output of gold, fully 200,000 oz.—value ...		£800,000
	Capital called up by 196 public companies ...		208,000
			£1,008,000
Cr.	Dividends paid by 37 public mines	£333,000	
	Wages, work, and charges ...	545,000	
			878,000
		leaving	£130,000

the aggregate accrued profits for the last 12 months against £47,000 in 1881. During 1882, Sandhurst has contributed nearly half the gold and dividends obtained in the colony. We employ about 6,000 miners, and our population may be set down at 30,000. The industry here is at present very attractive indeed, and 1883 is likely to witness some rather startling developments. The interests involved are indeed enormous. The nominal capital of 100 mining companies is £3,500,600; 80 companies have called up over £800,000, while the profits distributed by 64, from the outset, exceed £3,500,000. The interest on the capital invested in machinery in Bendigo is fully £20,000 a year, and the annual outlay for Timber for mining purposes is £70,000.

The yearly distribution by the local water-works supply is approximately as follows :—

For sluicing	912 million gallons.	
For crushing mills, and boilers	183	,, ,,
For domestic purposes, and baths ...	547	,, ,,
For fountains, and street watering ...	183	,, ,,
Total ...	1,825 million gallons.	

The dividends paid by gold-mining companies in the colony of Victoria for the past year were fully £800,000—being nearly double the amount declared by all the banks, insurance companies, and other public joint stock companies put together.—*Extract from a private letter from Sandhurst.*

Cost of Mining, Milling, Wages, &c.—Tabulated statements of the operative costs at some forty and more quartz establishments in California employing 2,440 men above and below ground, present data for the following averages :—Mining $5·75 per ton, milling $2·00 per ton. Total $7·75. Wages $2·80 per day. The labour of one man handles about 172½ tons yearly, hence the manual labour cost of one ton is $4·87, and cost of power, supplies, &c., $2·88 per ton. It is to be remarked that the above includes the best paying mines, and but few of the concerns working low-grade ores. The cost of mining indicates narrowness of vein, or a great surplus of worthless rock in the mines worked. In Colorado, mining is done as low as $1·90 per ton. Doubtless a fair average cost would be from $3·50 to $4·00 per ton. Milling about $2·00 per ton. Wages $2·00 to $2·50 per day.—*From Raymond's Reports.*

Auriferous Sulphides.—In Russian solid-rock mines, gold is most plentiful where the drift is most largely charged with iron. In Virginia, the gold is most plentiful in the brown ore, and in the joints and cavities of the bed. As in Brazil, the gold is most plentiful when the iron ore and quartz are combined, and most scarce when either is alone. In Nova Scotia, veins bearing quartz in which free gold is disseminated contain copper pyrites, with occasional galena, silver glance, metallic silver, and iron pyrites. At Morro Velho, experience shows that a mixture of iron and quartz makes the best matrix for gold, the metal being abundant where they are pretty equally mixed, but scarce where either prevails separately. In Australia, the gold is usually associated with iron pyrites and titaniferous iron ; the productiveness of the quartz or otherwise appears to depend chiefly on the age of the quartz, and, as in Brazil, in the presence of iron pyrites. Besides occurring associated with pyrites in granite rocks, gold also occurs disseminated in pyritous diorites, in pyritous felsites, and also in pyritous quartz and calcspar veins, usually well-defined, wide, and persistent. In quartz it is most abundant where iron pyrites, titaniferous iron, and other ores of iron prevail.—*Davies.*

Height of Outcropping.—The highest underground and hydraulic mines in the world are those of the *Little Annie* and *Summit*, Rio Grande County, Colorado, 11,000 and 12,000 feet, respectively, above the level of the sea.

Width and yield of some Veins.—The territorial assay records of 108 statements officially made as to the width of fissure veins in Colorado, vary from one foot to eight feet, and average slightly over four feet. The average width of really productive lodes may be set down at three feet, all subject to contractions and expansions, sometimes pinching to a thread, at other places bulging into enormous lodes. The *Mother Lode*, the great vein of California—estimated length from eighty to one hundred miles,—varies in width from a few inches to 30 feet. *Long Tom Mine* from three to eight feet wide; *Mammoth Lode* from three to eight feet wide; *Princeton* two to seven feet; *Hayward Mine* 18 to 20 feet; *Jefferson Mine* six feet; *Sierra Buttes* six to twelve feet, but sometimes 16 to 30 feet. The yield from *Long Tom Mine* averages $20,000 per month; average expenses $3,000 per month; *Mammoth Lode* yielded $1,000,000; *Princeton* $3,000,000; *Hayward Mine* $3,000,000; *Jefferson Mine* $13,500 per month; expenses $4,500; *Sierra Buttes* from 1861 to 1866, $1,345,000; expenses $460,000; profits $885,100.—*Mears' Industrial Progress in Gold Mining.*

Manufacture of Steel from Pyrites residuum.—The importance of the manufacture of steel from the residuum of pyrites roasting furnaces, will be readily understood when it is considered that in France, England, Belgium, and Germany, upwards of 800,000 tons of pyrites are annually consumed, producing after roasting in the furnaces upwards of 525,000 tons of peroxide of iron, containing less than one per cent. of sulphur, and which constitutes, after being treated and purified according to this invention, a very rich iron ore, valueless for the manufacture of chemicals, and which has hitherto been neglected by iron manufacturers on account of its friability, which causes it to fall to a very fine powder and to obstruct the blast-furnace, on account of the metalloids it contains, which render the iron brittle. The object of the invention of Mr. Clement Martin of Bleyberg-Montzen, Belgium, is to utilise the iron contained in the said residuum by transforming it directly into steel of different degrees of carbonisation, and it consists of the processes hereinafter described for the treatment, purification, and reduction of the said residuum. When the residuum of the pyrites-roasting furnaces contains more than one per cent. of sulphur, it should be roasted again, in presence or not of oxidising or desulphurising agents, to deprive it of its sulphur. The residuum of the pyrites-roasting furnaces containing less than one per cent. of sulphur, is reduced to powder; it is then placed upon sheet iron plates perforated with holes of about 1-25th inch in diameter, and is washed in a trunk or vessel mounted upon fixed or shaking tables so as to enrich it, or it may be simply washed or cleansed in cases, or tanks, through which a stream of water is caused to flow, so as to enrich the residuum by depriving it of its earthly parts, and those which are soluble in water.

The residuum, or ore, thus prepared, is then mixed with coal or suitable carbonaceous matter, in proportions varying according to the quantity of iron it contains, and the degree to which it is carbonised. To the mixture of ore and coal is then added very unctuous clay and lime, or any other like material capable of forming a very fusible flux in proportions varying according to the physical state and the chemical nature of the ore. The mixture, or mass, thus obtained, is moistened with water rendered alkaline, or acid, as required, and then converted into blocks or cakes, by being subjected to powerful hydraulic or other pressure in cylindrical or

other moulds. The said blocks or cakes having been dried, are introduced into a furnace, hereinafter alluded to as the calcinating and reducing furnace, in which they are for a suitable time exposed to the influence of heat and a reducing atmosphere. The iron contained in the said blocks or cakes under the influence of the elevated temperature in the calcinating and reducing furnace is reduced, a portion of the lime combines with the sulphur and phosphorus, whilst part of the unctuous clay agglutinates, and greatly hardens the mass and increases its density, and parts of the same are scorified with the gangue and lime forming with them a most fusible scoria or slag, which is removed to the melting furnace in which the next operation is effected. The next operation is carried on in a melting furnace (or other suitable apparatus) heated by ordinary fuel, or in which the fuel is gasified, and used in the state of gas. The said furnace or apparatus, the concave sole of which has been previously charged with the highly fusible scoria or slag produced in the calcinating and reducing furnace, hereinbefore described, is heated to a bright red heat. The blocks or cakes, also heated to a bright red heat, are introduced into the bath of melted scoria or slag by means of a self-acting duct, without any loss of heat, and sink into and are immersed in it by their own weight.

Under the influence of the elevated temperature of the furnace, from which free oxygen is excluded, the reduction of the iron is completed, whilst at the same time it is carbonised by means of the surplus coal which has not served for the reduction. The gangue forms with the lime and clay, forming part of the blocks or cakes introduced into the bath, a basic scoria, or slag, which entirely covers the melted metal, and preserves it from oxidation, and owing to the silica it contains, and also to its chemical properties, it becomes a powerful agent of desulphuration and dephosphoration. When all the chemical reactions hereinbefore described have been effected, the operation is terminated, and the scoria or slag having been removed from the furnace, the steel is run into suitable ingot moulds for use as required. The processes and operations described are also applicable to the manufacture of steel from ordinary iron ores.

The Mears' chlorination process.—This process is an improvement on that of Plattner. In roasting, the pulp, as the ore is called when it comes from the stamps, is loaded in trucks, run down to the roasting-house, dumped into the flue of the furnace, and through openings on each side spread out to dry by a man with a rubble. As the ore dries, it is pushed on to a revolving hearth, which holds a ton of ore, and constantly kept turned over. The roasting takes from six to eight hours and about ½ cord of wood is used per ton of ore. The sulphur and other volatile matters are thus driven off, the gold remaining in the form of a metallic dust, and free gold can be seen by panning. The ore which has lost about 7 per cent. in weight by roasting, is spread out on the cooling floor for chlorination. From the cooling floor the roasted ore is elevated into a truck, capacity one ton, on to the second floor of the building, weighed and dumped into an iron revolving cylinder of similar capacity, which is lined with lead, into which 140 gallons of water are put, also 40 lbs of chloride of lime. The cylinder is then rotated for a few minutes to mix the lime and roasted ore; 3½ gallons of sulphuric acid is poured into the cylinder, the top firmly screwed down, and the cylinder revolved for one hour. The chlorine gas gives a pressure of 20 to 25 lb. to the square inch. If much copper is present in the ore, a larger proportion of lime and acid are necessary. All the gold contained in the ore is dissolved, forming a solution of terchloride of gold.

The excess of gas is passed into the next cylinder, or drawn off into the flue, and the contents of the cylinder discharged into a leaching vat, or filter. The filters.

are flat wooden vessels lined with lead, 8 feet by 6 feet by 18 inches deep ; the bottom covered with perforated tiles. On top of the tiles is a layer of crushed quartz, about the size of a pea, and on top of the quartz, 3 inches of sand, protected on top by strips of wood. The contents of the cylinder are distributed evenly over the strips of wood, and the solution of chloride of gold is run off into wooden vats lined with lead, holding 700 gallons. The precipitate used is sulphate of iron, made of scrap iron and sulphuric acid and water, one part of the former to eight of the latter, and warmed by steam. The solution of sulphate of iron in the proportion of 6 gallons to 500 gallons of terchloride of gold is put in, well stirred, and the whole allowed to settle for 70 hours. The gold is precipitated in the form of a brown powder, and the liquid drawn off with a syphon. The brown precipitate, which is gold in a fine state of division, is treated with muriatic acid, well washed and filtered, then smelted in a crucible with some borax and nitre.

The approximate cost of working one ton of ore in America is as follows—Mining and milling, 1*l.* 10*s.* ; roasting, 15*s.* ; chlorination, 12*s.* = 2*l.* 17*s.* If therefore any particular ore yields a steady average of about 1 oz. of gold to the ton, there is no reason why a good profit should not be made on working the property.—*From a letter to the Mining Journal. Note.*—It is claimed for the Mears' chlorination process, that it will save 95 per cent. of the gold contained in the pyrites.

Mining in the United States in 1863-65.—During these years 195 companies, were organized in the East, of which 121 were located in New York city; of these 142 companies had a capital of $126,951,420. The aggregate reached some $160,000,000. From 15 to 20 per cent. of this nominal capital was paid up and expended in purchase, in contracts for machinery, in transportation, construction, and development. By 1866 nearly all of these organizations had ceased active operations. Some had failed, all were discouraged. The mills, costing large sums of money, and freighted at $600 per ton had failed to treat the sulphides profitably.—*Mears' Industrial Progress in Gold Mining.*

Pyrites at the St. John del Rey Mine.—The mineral treated contains between 40 and 50 per cent. of pyrites, and a large portion of that is arsenical. Quicksilver will not attach itself to gold easily, but the two metals have to be kept in contact until they do amalgamate ; this necessitates a certain amount of interruption in the process, but cannot be avoided. The amount of mineral treated per day is from 150 to 200 tons, the cost of extracting the gold and returning it in bullion, passing through the following processes—stone-breakers, stamping mills, concentrating sluices, arastras, re-stamping, re-concentration, amalgamation, sublimation, assaying, and gold melting—is found by looking at the company's printed report for June 1881, to be 4*s.* 11$\frac{3}{4}$*d.* Although this figure includes all wages, salaries, and repairs to machinery, yet it is considered very high. It must be clearly understood however that no steam-power is used, but all the motive power is derived from water. For many years the company has given the most brilliant opportunities to inventors and patentees, and has spent a great deal of money in experimenting on a large scale in order to improve or introduce a better system for the reduction of their mineral ; but the old process has held its own against them all, and the world fails to produce anything equal to it for cheapness or efficiency.—*E. Fox Butlin in the Mining Journal.*

Mining in Victoria in 1881.—Just 31 years have elapsed since the first discovery of gold in the then newly-established colony of Victoria ; and although during the last few years a decrease has taken place in the quantity of the precious metal

raised, the industry is perhaps on a more satisfactory footing than it has ever been before, those engaged in it being more regularly employed, and a large amount of capital and better appliances in rock boring and other machinery being used. One shaft at Stawell exceeds 2,000 ft. in depth while there are some twenty others which have attained a depth of over 1,000 feet below the surface. Over 1,000 steam engines, valued at nearly two millions sterling are employed in gold-mining in Victoria alone. The mineral statistics of the colony for the year 1881 give the total amount of gold received during the twelve months ended December last at 833,078 ozs., which valued at 4*l.* per ounce, would give a value of 3,333,512*l.* These figures show a considerable increase over any previous year since 1876. The returns for the first quarter of the present year show a further increase which favors the hope that the returns of 1881 will be exceeded by those of 1882. The returns of last year, high as they are, are only about one-half of the average annual yield of the period between 1851 and 1880; but against this fact must be placed the circumstance that the number of miners has steadily diminished. So recently as 1869 the number of miners was 63,787, when the yield was 1,337,296 ozs., giving an average of a little under 21 ozs. each; while last year the number was under 40,000, which would give a slightly higher average yield. Thus the actual productive power of the gold-fields remains about the same, though, owing to the inducement held out by high wages in other fields of labour, and to the gradual decrease of the gold-fever, the number of persons "trying their luck" on the fields has fallen off.—*The Colonies and India.*

The Readwin process.—In September 1882 an unsuccessful attempt was made to float a Company called *The Gold Amalgamating Company, Limited*, whose object was to introduce a new method of amalgamation known as the "Readwin process." This was represented to be a secret mode of treating quicksilver for amalgamation, and an improved apparatus called the "Ore grinding and amalgamating machine." It was claimed for this process that it obtained—

I.—The more economical treatment and perfect extraction of the amalgamable gold and silver from auriferous minerals; *viz.*,—(*a*) from minerals containing free gold associated with arsenides, sulphides, tellurides, antimonides, &c.; (*b*) from low grade ores and tailings containing finely divided gold, float-gold, or both, in quantities insufficient to pay for working by the ordinary methods.

II.—The economic concentration, after the extraction of the gold, of the metallic sulphides, &c., thus rendering them marketable, and more valuable.

III.—Safe-guarding the quicksilver and amalgamated gold from theft.

The following remarks are taken from the prospectus of this Company:—

The extraction of gold from its ores has only ranked as a commercial industry for a little over a quarter of a century, yet the progress made, both in the extraction of the precious metal and in the mining of the ore, has been so rapid, that judging from external appearances, one would be disposed to class it amongst the businesses carried on from time immemorial. The treatment of gold ores, as long carried on in the old colonial dependencies of Spain, in South America, was so unquestionably slow as to bear no comparison with the processes which have since become common on the Pacific slope of the United States, and it may safely be said many millions of tons of auriferous material, which has been made to yield large profits in the Western States, would have been condemned as worthless or intractable, in Brazil, or other countries of South America. But that perfection has been reached is not pretended, and, just as 30 years ago the treatment of gold associated with sulphides

was declared to be incapable of yielding profits, whilst at the present time that very class of ore now yields most of the wealth of the gold districts, so the now disputed occurrence of salts of gold in nature may be verified in such a manner as to prove immensely profitable to those earliest in the field of investigation on the commercial scale. It will readily be acknowledged upon glancing at a list of the now recognised metals—sodium, aluminium, magnesium being worthy of mention as being familiar to all—that many of them were either absolutely unknown at the beginning of the century, or so extremely rare that only a few of the most celebrated Chemists had ever had the satisfaction of seeing them, yet at the present time they are of considerable industrial importance. Even 30 years ago, sodium which now plays a prominent part in obtaining other previously rare metals, was looked at with amazement if a lump the size of a walnut was exhibited, and the production of aluminium and magnesium on the commercial scale was still more recent.

Iron Pyrites.—Iron pyrites is not primarily used as an ore of iron, but of sulphur, and it is from it that the great bulk of the sulphuric acid of commerce is produced. Before 1838, sulphur had been exclusively used for the manufacture of this acid, but in that year the price was nearly trebled owing to a monopoly granted by the King of Naples; this lead manufacturers to turn their attention to other sources of sulphur, and the use of pyrites so rapidly extended that in less than 40 years afterwards (1874) no less than half a million tons were imported into Great Britain for the purpose of this manufacture. Details concerning it are unnecessary, but the ore is broken into small pieces, burnt in kilns, and the resulting sulphurous acid gas passed into leaden chambers, where with the aid of steam, &c., it condenses as sulphuric acid. After yielding its sulphur in the form of sulphuric acid, the cupreous pyrites cinders are generally treated for the extraction of copper, previous to which, however, the silver, to the amount of about 18 dwts. per ton, and also a small amount of gold is extracted by what is known as Claudet's method, by which it appeared on treating a large quantity of burnt ore at a Widnes works that 0·65 ozs. silver, and 3 grs. of gold, per ton might be extracted from Spanish pyrites, and with considerable profit. After these metals have been removed there remains only the oxide of iron, with some silica, &c., and this is finally worked up for the making of iron and the lining of iron furnaces, so that there is not much of the original ore left to be utilised.

The Sandhurst Mines.—Most of the readers of the *Times* will remember the discussion which a year or two back took place in the London Press, on the apprehended gold famine. There seems to be little prospect of this at present, so far as the Australian gold-fields are concerned. I have in former letters stated that the diamond drill was working a revolution in mining. Before the use of this instrument the only means of exploring at great depths was by sinking a shaft, which frequently cost many thousands of pounds without any profitable result after all. The diamond drill goes through the hard basalt with a rapidity which enables a miner to do in hours what it took days to do by the older processes. Much new deep ground is now being tested in this way, especially in the Sandhurst and Creswick districts; and with a success beyond even the sanguine hopes of miners. Mr. Brough Smyth, formerly Secretary to the Victoria Mining Department, and who, after a long official engagement on the Indian gold-fields, has recently returned to this colony, thus writes to the *Argus*, an interesting account of a recent visit to our Sandhurst district:—

"The reader can judge for himself of the productiveness of this district. The yields of gold at Sandhurst for the first seven months of the past three years, as

compiled by the receiver and paymaster, from returns furnished by the banks, are as follows :—

	1880.			1881.			1882.		
	ozs.	dwts.	grs.	ozs.	dwts.	grs.	ozs.	dwts.	grs.
January	12,956	14	13	13,113	8	0	10,577	2	16
February	12,831	10	13	16,392	5	0	12,278	9	11
March	13,456	13	11	14,026	8	14	12,918	18	20
April	11,349	0	0	13,123	13	0	14,279	11	4
May	15,272	15	14	14,332	8	14	18,332	14	4
June	14,402	10	18	15,087	15	5	18,565	11	5
July	14,438	13	2	17,097	17	4	18,777	1	13

Separate accounts of the gold got from quartz and the alluvia are not kept, but it is estimated that 1,000 ozs. monthly of the above is alluvial, and the rest reef gold. The larger and regular increase is encouraging."

Now this increase of which Mr. Smyth writes, it will be seen, on examining the above table, is very marked in the months of April, May, June and July of the present year, the diamond drill being now very commonly employed. In the Kingston district enormous yields are being obtained from great depths, and mining enterprise is becoming as rampant as ever it was in the palmy days of 1852 and 1853.—*Times' Melbourne Correspondent.*

Evans' Chlorination Process.—This improvement consists essentially in the use of chlorine gas under sufficient pressure to accelerate its action in reducing the metals to the form of chlorides, and in recovering the unused or uncombined gas from the ore, undiluted, and in the same condition as when it entered the chlorinator. The process of course necessitates the use of special apparatus. In the ordinary, or Plattner's process of chlorination, the chlorine gas is used under a normal pressure, or one just sufficient to cause it to flow into the chlorinator, and the time required for the most perfect reduction is 48 hours, while Mr. Evans effects the same reduction in one hour, or even less. Retaining the gas for 48 hours in the presence of water converts nearly, or quite, all of it into chlorhydic acid, and if any of it remains, it is so diluted with air, that its further use is impracticable. The short time and the low temperature at which the gas and ore brought into contact in the chlorination according to this invention, prevent the formation of chlorhydic acid, and as the air is exhausted from the chlorination before the introduction of the chlorine, it is recovered in an undiluted condition.

In practice Mr. Evans provides a chlorine generator, which may be of any of the common forms, and a gasometer for storing gas from the generator, and that which has been recovered from the chlorinator, it being connected with the generator by pipes, and with the chlorinator by other pipes. He employs a chlorinator which is in the form of a barrel, which is arranged to revolve and supported on trunnions, and driven by a pulley, and a goose-neck is passed through one of the trunnions into the open space above the charge; a pump is connected with the gasometer by the pipes, and with the chlorinator by other pipes and the goose-neck. He moreover provides a receiver for storing gas under pressure which is connected with the pump by pipes and with the chlorinator by other pipes and the goose-neck. An exhaust apparatus is used, which may be a pump, water column, or any suitable contrivance, it being connected with the chlorinator by a pipe and the goose-neck and with the receiver by other pipes. There are cocks or valves to connect or disconnect the different parts of the apparatus.

The mode of procedure in conducting the process need not in every case be identical; but it will suffice to describe two which answer quite well in practice.

The gasometer being put in order for holding the gas, the generator is then charged with the necessary materials in the proper amounts for generating chlorine gas, which, passing through the pipes, fills the gasometer. Connection is then made between the exhaust and the receiver, from which the air is exhausted, after which the connection is closed, and connection made between the receiver and the pump, which is then connected with the gasometer, and started pumping the gas from the gasometer into the receiver until a pressure of 50 or 60 lbs. is obtained in the receiver. The chlorinator is then charged nearly full of ore and water, leaving only the point or opening in the goose-neck not submerged, and it is made to revolve at the rate of 20 revolutions per minute. Connection is now made between the exhaust and the chlorinator through a pipe and goose-neck, and all air exhausted from the chlorinator; this connection is then closed, and the one between the chlorinator and receiver opened, when the gas from it passes into the chlorinator, subjecting the ore in it to a strong pressure. After the ore has been under the gas for one hour or less according to its nature, connection between the receiver and chlorinator is closed, and it is connected with the gasometer, when the greater portion of the gas passes into it. The chlorinator is now connected with the pump, and any gas remaining in the chlorinator is pumped into the receiver until the chlorinator is exhausted. The ore and water are then discharged from the chlorinator, which is then ready for another charge. After chloridising, the ore is filtered, and the gold precipitated and collected in the usual way.

In working the process according to the second method, the chlorinator is charged with ore and water as before. Into it is then put a proper proportion of chloride of lime, the whole being thoroughly incorporated by rotating the chlorinator. The rotation is then discontinued, and dilute sulphuric acid is now added to the mixture and the tank is rotated again, when there is produced a large excess of chlorine under pressure, by the chlorine gas being evolved from the chloride of lime by the sulphuric acid, sulphate of lime being formed, and chlorine gas thrown off. The rotation continues from one half-hour to three hours, according to the nature of the ore, when the chlorination is complete. Rotation during the chlorination has the effect of expediting the chemical action involved. The chlorinator is now tapped, and the excess of chlorine is drawn off into a gasometer, or in the absence of the gasometer, (which with the pump, generator, and receiver, may be dispensed with by this method) may be conducted by any suitable device away into the air. The free chlorine remaining in the chlorinator having been expelled in the usual way the chlorinator is emptied into a proper vessel, and the metallic chlorides collected as usual.

Quicksilver.—The following statistics of prices, production and consumption are given by a correspondent of the *Mining Journal*.

	Highest.			Lowest.				Highest.			Lowest.		
	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
1850 ...	15	0	0 ...	13	2	6							
1851 ...	13	15	0 ...	12	5	6	1861...	7	0	0 ...	7	0	0
1852 ...	11	10	0 ...	9	7	6	1862...	7	0	0 ...	7	0	0
1853 ...	8	15	0 ...	8	2	6	1863...	7	0	0 ...	7	0	0
1854 ...	7	15	0 ...	7	5	0	1864...	9	0	0 ...	7	10	0
1855 ...	6	17	6 ...	6	10	0	1865...	8	0	0 ...	7	17	6
1856 ...	6	10	0 ...	6	10	0	1866...	8	0	0 ...	6	17	6
1857 ...	6	10	0 ...	6	10	0	1867...	7	6	0 ...	6	16	0
1858 ...	7	10	0 ...	7	5	0	1868...	6	17	0 ...	6	16	0
1859 ...	7	5	0 ...	7	0	0	1869...	6	17	0 ...	6	16	0
1860 ...	7	0	0 ...	7	0	0	1870...	10	0	0 ...	6	16	0

	Bottles.	Highest. £	s.	d.	Lowest. £	s.	d.
1871 ...	79,200	... 12	0	0	... 9	15	0
1872 ...	80,900	... 19	0	0	... 10	0	0
1873 ...	76,800	... 20	0	0	... 12	10	0
1874 ...	79,900	... 26	0	0	... 18	10	0
1875 ...	110,400	... 22	0	0	... 9	10	0
1876 ...	127,400	... 11	10	0	... 7	17	6
1877 ...	132,900	... 9	10	0	... 7	2	6
1878 ...	119,900	... 7	5	0	... 6	7	6
1879 ...	133,500	... 8	15	0	... 5	17	6
1880 ...	115,600	... 7	15	0	... 6	7	6

The consumption is estimated as follows :—

	Bottles.		Bottles.
Europe (excluding England)	30,000	to	35,000
England	12,000	,,	15,000
California	8,000	,,	12,000
Mexico and West Coast	20,000	,,	25,500
China	25,000	,,	30,000
New York, &c	10,000	,,	12,000
Sundries	2,000	,,	3,000

Dynamite and Powder for Mining Purposes.—The question is frequently put as to whether dynamite or powder is the most economic agent for blasting in the carrying out of mining operations under certain conditions, but we are not aware that it has been satisfactorily answered by those who have tried both explosives. Powder and dynamite however have advantages separately from each other, according to the position they are placed in, and the work required of them. In blasting, in sinking shafts in particular, we are informed by a mining engineer of great experience, the nature of the strata to be gone through, as well as other circumstances, must be taken into consideration. Where there is a considerable quantity of water to be overcome, there is no question that dynamite is the best agent which can be used, for by it a hole can be stemmed with water, and got down so that there was no fear of its striking fire. A larger amount of work in a given time can be accomplished by dynamite as compared with powder, so that where there are large feeders of water, and where speed is a matter of importance it is admittedly the best for blasting. In ordinary sinkings with gunpowder it has been found that the hole should have a 3 inch guage, but one about 1½ inch is sufficient where dynamite is used, consequently there is a considerable saving in the time occupied in boring holes as regards dynamite. As a rule powder will make a long cut on the top of a hole, but it does not enter the earth the same as dynamite, by which the broken ground is much easier to remove, whilst where there is a perfect explosion of the latter there are no fumes, but, if imperfect, of course fumes arise. With dynamite also the whole force of the explosion is at the bottom. This is shown by placing the two explosives on a stone, when it will be found that the dynamite will fracture the stone, while the powder will not do so. However, in fixing upon the material to use as an explosive agent, it is necessary to take into consideration the nature of the stratum which is to be attacked, whether it is hard or soft, and whether the work will be dry or wet. If powder is decided upon, care should be taken to obtain it genuine, for there is a great deal sold which has apparently very little power, for being a mechanical compound it is frequently adulterated by the substitution of a portion of soda for saltpetre. Where really

good powder is used, and kept free from wet or dampness, and where the ground is dry and comparatively soft, gunpowder will probably be found as effective as dynamite, and rather cheaper. The conclusions which may be come to from the experience of those who have given a good deal of attention to the two materials are, that where work has to be carried on in wet ground, a considerable amount of water constantly coming out, and in the blasting of rock, dynamite will be found the most effectual agent, and the most economical, much more work being also done in a given time. In dry sinking, and with moderately soft strata to go through, powder of good quality, on the other hand, will be found as good an explosive as can be adopted economically or otherwise.

Winding Machinery.—The American Winding Machinery for very deep mining is characterised by a proportionate strength, great weight of metal, compactness, and unusually effective brake power. Amongst these winding machines, one had just been built in San Francisco by Messrs. Prescott Scott and Co., who very kindly afforded me every opportunity to inspect some, and to procure full working tracings with other particulars. As this machine has been calculated to wind from the future 4,000-foot level by the *Yellow Jacket* Company, Comstock lode, if required, I was very glad to get this information as a guide for our future endeavours in the same directions. The two coupled cylinders were each 26 inches in diameter, with a stroke of piston of 6 feet; and both cylinders, drums and gear are all fixed to one solid bed-plate. The cranks—Californian engineers discard cranks, and have solid hammered-iron discs instead—and the winding shaft is made of best hammered-iron, splendidly finished. The winding shaft, 16 inches in diameter, is round, except at the boss for spiders, where it obtains an octagon shape for a diameter of 18 inches. The ordinary speed for winding is not less than 55 feet per second, and by means of clutches winding can be done from any given depth, or also at various speeds. These large engines are all worked, in California and Nevada, and looked after, by a double set of drivers each shift, or, in other words each driver has one drum and half the machine under his control, whilst firemen look after the boilers. The machine in question, inclusive of an equally powerful pumping engine, would consume 30 cords of firewood (pine and oak) every 24 hours, which fuel is delivered at the mines at 14 dollars per cord, or about 55 shillings. The poppet-heads, or gallows for this same plant are to be of clear sugar-pine, the two principal supports, or legs, measuring 18 inches by 24 inches diameter, and 50 feet high. These are to be fixed, like all others in those mines, 10 feet clear of the ends of the shaft, thus being—as the shafts are usually 20 feet long in the clear of timber—40 feet apart, giving good room all round the pit's mouth. The sheaves are of cast iron with wrought iron rims shrunk on, and measure from the centre of the spindle 6 feet to outer rim or periphery. All the appurtenances are constructed with a view of doing a very large amount of work in a short time; and as the companies generally enter into contracts with the crushing mills for the supply of regular quantities of ore per diem, some such precautions are essentially necessary. The "cables" or flat steel ropes are of various sizes; for instance that at the pump-shaft, for special use by the sinkers in the combination shaft of the *Virginia* and *California* Companies, Comstock, measures but 4 inches by $\frac{1}{2}$ inch, whilst the two winding ropes in their respective shafts are 5 inches by $\frac{5}{8}$ inch. The average amount of work of these three winding drums amounts to 800 tons lifted in 24 hours from a depth of 1,500 feet, but as many as 445 "cars," or trucks, weighing 1,900 lbs each have been landed in eight hours at the pit's mouth. These steel cables are not only flat, but they also taper from their centre to the ends, on account of the ever

varying weight of that cable and which is deepest in the shaft. For instance in a shaft 2,000 feet deep, a steel cable of the kind described weighs about 53 cwt., which, if 10 per cent. is deducted for the distance between the engines, sheaves, and mouth of shaft, leaves 43 cwt. in the shaft; this weight changes continually, so that when the bottom cage reaches the surface the weight of rope will be reversed. During the first part of the winding, the power much exceeds that required half-way up, and at the latter end the engines have actually to be 'braked' in order to meet the increasing and more than counterbalancing weight of the descending cage and longer rope together. What strikes one as most unusual, was the extreme care which the mine superintendents generally bestowed on these wire ropes, and the observation of these officials, that "they (the ropes) formed the only link by means of which many valuable lives could hope to see daylight again" appears very appropriate under the circumstances. All these ropes are stored in a drying shed, after each rope had run 'four months' over the sheaves; they are then taken off, cleaned, and carefully repaired whenever necessary, and finally they are given a good coat of coal tar mixed with asphaltum warmed to liquidity. After that they are rolled upon wooden spiders, and allowed to dry for the next eight months, during which frequent examinations are made to see whether they show signs of rust, whereupon they are again cleaned and coated as before; thus each rope is used but four months out of twelve. Each drum is geared with an indicator to show the position of the cages in the shaft; this is effected by keying a small bevel wheel on the end of the winding shaft, or next to the clutch and close to the spiders, which works another wheel at right angles, also keyed on the bottom end of a vertical shaft 20 feet in height, 3 inches thick, with three square threads cut into it to the inch vertical; this screw grips into two kinds of hands at each side of the main screw, and as this screw exhibits 15 feet for every inch, the total depth, and over, of the shaft is covered, and these hands show very correctly what position the cages are in, by their being either raised or depressed, so that the index provided and divided into feet, as painted in large figures, forms a correct guide for the driver.—*Thureau.*

Barker's Electrical-Amalgamator.—We need hardly say that chemists and others have for years attempted to hit on some expedient for cleaning "sick" mercury without retorting, and the result can be attained in two ways. Thus, a small quantity of sodium added to the metal restores its power of amalgamating with gold, owing no doubt to the remarkable power which sodium possesses of making metals alloy. Thus, if a little sodium amalgam be rubbed on a bit of hoop iron, the iron may be dissolved in a pot of melted zinc. The mercury can also be cleaned by blowing chlorine gas through it. Neither plan has, however, met with much practical success. Sodium is not easily obtained in sufficient quantities, and it is not a very nice thing to carry up-country to wild and out-of-the-way districts. There are obvious troubles again connected with the use of chlorine, and so neither have, as we have said, met with much, if any favour from practical gold miners.

Some months ago Mr. Richard Barker, of Norfolk Street, a member of the Geological Society, discovered—for we cannot say invented—a very curious phenomenon, namely, that if mercury be used as a cathode, while a copper or other metallic electrode is immersed in water covering the mercury, the mercury will immediately begin to expel any impurities which it contains, except metals. This principle he has applied to the purification of mercury in gold riffles, and with remarkable success. The invention—for the discovery referred to above had to be reduced to a practical form, in the shape of suitable apparatus—has been taken up by the Electro-

Amalgamator Company, and a riffle has now been at work in Southwark for some little time. This riffle consists of a wooden trough, about 3 feet wide, and 12 feet or 14 feet long, with the usual mercury troughs across it. Along one side of the trough run two iron bars, one of which forms one side of an electric circuit, while the other forms the other. Rods of iron dip into all the mercury troughs, and put the mercury on the negative or return side of the circuit; similar rods are connected with bars, one of which lies across the riffle over each mercury trough, and from this bar, strips of copper about 1 inch wide and 8 inches long extend and lie horizontally over the mercury, which is thus under, so to speak, a huge comb, the teeth of which are about 8 inches apart. The distance between the mercury and comb-teeth is about one-fourth of an inch, and so long as the riffle is dry, no current can pass. Close to the riffle is a very simple and inexpensive dynamo, wound for quantity only, with very coarse wire. Over each comb is fixed a small roller or axis of wood in which are stuck pegs, which pegs dip into the mercury between the comb-teeth. The dynamo is driven by a small gas engine, and the pegged rollers are caused to revolve at the same time, the pegs agitating the surface of the mercury. The ground quartz, and a full stream of water descend the riffle from the top as already explained, and the water flowing over the mercury and touching the comb-teeth, contact is at once made, and a current flows from the whole lower surface of each comb-tooth through the water to the mercury. The effect produced is magical. No matter how "sick" or foul the mercury is, the moment the current is turned on, the impurities fly from the space below the comb-tooth, and collect in narrow ridges in the intervening spaces, from which they are washed away by the current of water, and the surface of the mercury at once becomes as bright as silver. We have seen quartz used, heavily charged with sulphur and arsenic from sulphur pyrites. One shovelful of this stuff sufficed to sicken all the mercury in the riffle, and the mercury was brought back to condition in less than one minute after the current was turned on. With the current flowing, the mercury could not be made sick. One experiment which we witnessed showed in a startling way the effect produced by the passage of the current. Four or five pounds of clean mercury being put into a china bowl, some oil was added, and the whole beaten up with a stick to a species of ointment, a process which occupied five or six minutes. A sovereign dropped into this mixture of oil and mercury came out untouched by the mercury. For all purposes of amalgamation the mercury was useless, and must remain so until retorted. The bowl was now nearly filled with water, and the end of a negative wire from a battery was plunged into the metal and oil, while the positive wire was just dipped into the water, which stood two or three inches deep. The moment contact was made with the water the oil began to rise in streams from the mercury, which could be seen collecting itself into little drops, two or three of which would coalesce. In about three minutes the whole of the oil had come to the surface of the water, and the mercury lay pure and bright at the bottom of the bowl.

We are unable to explain to what this action is due, nor are we aware that any chemist or electrician is in a better position to supply information. There are two or three theories at the service of our readers, all more or less—principally less—satisfactory. According to one of these the impurities on the surface of the mercury, or mixed with it, become electrified, and are repelled by the mercury, because they are not metallic. According to another, the molecules of mercury are polarised, and, changing their relations to each other, expel all foreign bodies. Another theory attributes the action to the formation of nascent hydrogen, which acts chemically on the impurities; and this theory

finds confirmation in the fact that pure water acts more effectively than any other liquid, the addition of any other liquid to the water, or of any substance soluble in it, apparently weakening the action of the current. It is a noteworthy fact that if the poles be changed, the cathode or negative end of the wire being in the water, while the anode or positive wire is in the mercury, the action is very trifling. If both ends are plunged in the mercury there is no action whatever. If a quantity of sickened or "floured" mercury be put into a large iron pan, and covered with water, experiments may be carried out which demonstrate the action of the current very clearly. Taking the positive insulated wire in the hand, an inch or so of the wire being left bare, while the other wire is plunged in the mercury, we can cause the impurities on the surface of the mercury to go in any direction we choose. They always fly away when the positive wire is pointed at them, just as dust will go before a blast from the nozzle of a pair of bellows. Indeed, it requires small exertion of the imagination to believe that a current of air proceeds from the end of the wire, and brushes the dirt before it. It has, we may add, long been known that the passing of a current of electricity through mercury tended to clean it, but the action was too feeble to be of any importance, and, so far as can be seen, the whole virtue of the Barker system resides in the use of water on the top of the mercury. As to the importance of the invention our readers can judge for themselves. It is to be hoped that a really satisfactory explanation of the action of the current will be forthcoming ere long.—*The Engineer.*

Wages.—In California men receive from 2½ to 3 dollars per diem, six days in the week, for either eight or ten hours' shifts. In some mountainous districts miners are boarded and lodged at the mines, and the amount (never exceeding 7 dollars per week in California) is deducted from their wages. Amalgamators receive from 4 to 5 dollars per day of twelve hours' shifts, and labourers from 1½ to 2 dollars ditto. Mine superintendents are salaried very high, and they receive from 30 dollars per week to 300 dollars per month. As regards miners and other employés' habitations, it was generally observed that their cottages were built of red pine, and that neat American stoves took the place of open bricked fire-places and chimneys. In Nevada on the Comstock Lode, the miners' wages are not less than 4 dollars per day for seven days in the week, and by a late agreement come to by most of the mine superintendents, and the very powerful "Miners' Union" of Storey County, Nevada, no miner is employed who does not belong to that society. At most mines it is customary to deduct one dollar per month for the hospital fund. Amalgamators, for twelve hours' shifts, get 5 dollars per diem; tankmen 4 dollars ditto; superintendents receive from 500 dollars per month downwards.—*Thureau.*

Diamond Drills.—The following are the conditions under which the Diamond Drills belonging to the Government are allowed to be used in the Colony of Victoria, in approved localities, at the instance of any local bodies, or individuals, hereinafter called the prospectors:—

1. The management, charge, and working of the drills, and the employment of the necessary labour, will be under the absolute control of the Mining Department.

2. The Government will pay all necessary freight and other charges for the actual removal of the machinery from one station to another on any railway.

3. The cost of providing all necessary carriage from a railway station or other place, and the fitting up of the drills upon any selected site, and all wages and other charges, including the cost of fuel, supply of water, and repair of breakages, shall be borne by the prospectors at whose instance the work is to be performed.

4. The prospectors shall, at their own cost, provide the necessary means for the

conveyance of the whole of the machinery and appliances from the nearest railway station or other place; but the arrangements for carriage shall be subject to the approval of the officer in charge of the drill.

5. A requisition for the estimated amount of the cost of working the drill for each month shall be furnished in advance to the prospectors, who shall, before the commencement of the month, forward the amount by bank draft, to the Secretary for Mines.

6. If the cost of working the drill during any month be less than the amount forwarded to the Secretary for Mines, the amount unexpended will be placed to the credit of the prospectors. If the cost, however, exceed the estimate, the excess will be included in the next requisition.

7. The Honorable the Minister of Mines reserves to himself the absolute right to suspend or terminate the operation of the drill at any time should he deem it necessary to do so; and the prospectors shall not be entitled to any compensation for such suspension of operations.