Dr. Rose has carried out a most elaborate series of experiments on the action of chlorine on fine gold at various temperatures. The fine gold was placed in a tube and dry chlorine gas passed over it, the tube containing the gold was placed in an oil bath and kept at a temperature of 180° C., the chlorine was absorbed by the gold and the resulting chloride was in the form of dark red shining plates and needle-shaped crystals.

The following table shows the percentage of gold volatalized in an atmosphere of chlorine, at various temperatures:—

Temperature in Degrees Centigrade.	Percentage Volatalized in 30 minutes.
180	0·007
230	0·35
300	2·32
390	1·82
480	0·88
580	0·60
590	0·58
805	0·50
965	1·63
1100	1·93

When gold chloride is heated in air no gold is volatalized below 1058°, and only about 0·02% in 30 minutes at a temperature of 1100°. "The amounts of gold volatalized vary according to two factors: (1) The vapour pressure of gold trichloride which of course increases continuously as the temperature rises; and (2) the pressure of dissociation of trichloride of gold, which also rises continuously with the temperature, but not at the same rate as the vapour pressure.

"The rise of the vapour pressure tends to rise, and that of the pressure of dissociation to reduce, the amount of gold volatalized as chloride. The vapour pressure increases more rapidly than the pressure of dissociation at temperatures below 300°, and also above 900°, but less rapidly at intermediate temperatures."

Dr. Rose's next experiments consisted of heating a mixture of mono and trichlorides of gold at various temperatures in air and in chlorine, the mixed chlorides were made by passing chlorine gas over fine gold at 210°-220°. When no more chlorine was absorbed the tube containing the chlorides was sealed, heated to 300° and the melted chlorides shaken up, allowed to cool and sampled. An analysis of the mixed chlorides gave

Metallic gold	Nil.
An Cl	18·81
An Cl_3	81·19

The following table shows the rates of decomposition of gold chloride in chlorine gas and in air respectively:—

Temperature.	Time of Treatment.	Analysis of Product, Percentages.			Percentage of An Cl_3 decomposed per hour.
		Metallic Gold.	Gold as An Cl.	Gold as An Cl_3.	
In atmosphere of chlorine.					
165°	4 hours	....	20 11	79·89	0·40
188°	18 hours	....	21·86	78·14	0·21
190°	8 hours	....	27·06	72·94	1·27
190°	24 hours	....	37·30	62·70	0 95
In air.					
100°	7 days	....	24·33	75·77	0·04
165°	4 hours	....	28·60	71·40	3·015
168°	18 hours	....	59·59	41·41	2·72
190°	10 hours	0.12	99·88	....	....
190°	24 hours	57·88	42·12	....	....
175-180°	6 days	100·00	....	....	....
155-163°	7 days	52 23	47·77	....	....

Trichloride of gold is completely decomposed in air in 36 hours at a temperature of 200°, and at the melting point 288° in less than one minute. These experiments of Dr. Rose's bear directly upon two well-known metallurgical processes, namely, the roasting of auriferous sulphurets, and the Millar process for the purification of gold bullion. This latter process, as is well known, consists of passing a current of chlorine through molten bullion, the silver and base metals are converted into chlorides and either float on the surface of the gold or are volatalized and pass away as vapour.

Now, according to Dr. Rose's experiments the gold volatalized as chloride would be somewhere about 3·86 per cent. per hour. Of course the process does not last for this length of time, but surely an appreciable amount of gold must be lost by it.

In the roasting of sulphurets without salt the amount of gold lost would be almost nil, provided always there is no telluride of gold present. But in the case of roasting with salt it is evidently different. It would appear from Rose's experiments that the proper time to add the salt would be at a temperature of from 600° to 800°.

Paul Jaunasch gives the following method of decomposing silicates:—Lead carbonate is prepared by precipitating a hot solution of lead acetate by ammonium carbonate, the precipitates is washed with water and dried in a porcelain dish. The silicate is mixed with from 10 to 12 times its weight of lead carbonate and placed in a platinum crucible, it is heated at first gently until most of the carbonic anhydride is driven off, then at a red heat. The hot crucible and contents are thrown into cold water, treated with nitric acid, and the solution evaporated to dryness. The product is dissolved in nitric acid and water, separated from the insoluble silica, and the greater portion of the lead precipitated, by the addition of concentrated hydrochloric acid. The salts are then converted into chlorides by evaporation with hydrochloric acid, and the remainder of the lead precipitated by hydrogen sulphide. The filtrate is freed from hydrogen sulphide and then subjected to the ordinary methods for the separation of the metals.

There is an exceptionally good series of lectures being reproduced in the *Society of Arts Journal* on "Recent American methods and appliances employed in the Metallurgy of Copper, Lead, Gold and Silver," and we propose giving an extensive review of them in our next issue.

Mr. Amos P. Brown, in the *Chemical News*, gives the results of the investigations he has made on the two forms of bi-sulphide of iron found in nature, namely, pyrites and marcasite. The former resists the action of air, and when decomposed in the earth gives rise to limonite, frequently in pseudomorphs, whereas the latter oxidizes readily into a sulphate, and only occasionally yielding limonite; pyrites is obtained when ferrous sulphide is deprived of iron by ferric salts or carbonic acid, marcasite when ferrous sulphate is reduced by organic matter. From an elaborate series of experiments (each of which was repeated ten times), which consisted of shaking the finely divided minerals with aqueous solutions of permanganate of potash of different strengths and at different temperatures and then determining the sulphuric acid formed and also determining the proportion of pyrites oxidized by electricity. Mr. Brown concludes that the composition of pyrites is 4 $Fe^{IV} S_2$, $Fe^{II} S_2$ while marcasite has the more simple composition $Fe^{II} S_2$, or a polymeride of it.

The Necessity of Competent Geological Surveys of Gold Mines.

Mr. Nicol Brown, F.G.S., in a recent paper before the Geologists' Association of London, enunciated that geology in competent hands is the first science for gold mining, and that no sure foundation is laid for other sciences to base their work unless the preliminary work of the geologist be well done. Whether a man goes to seek fossil shells or golden sands, the same qualities are required for success, the same intimate knowledge of nature and nature's laws, without which her thrilling secrets cannot be discovered. From the want of this knowledge, the ordinary uninstructed gold-seeker always defeats the end he has in view. He works hastily, and by imperfect methods, and never stops to mark the finger-posts or compass-points, which might guide him to the object of his search. The finding of gold must no longer be left to chance, but should be the result of well-designed and well-organized efforts, and the basis of that industry, which is now being built up, rests on geological surveys made by qualified men. These are now demanded, and must be obtained, and the gold miners can well afford to pay for them, and at a different rate from what has hitherto been paid.

Directors of gold mining companies have considerable difficulties to encounter in selecting employees who understand the various departments of the work. To the uninitiated these latter appear complicated; but in reality they are simple to those who take the trouble to spend the time and labor to learn about them. Directors of gold mining companies should, however, themselves learn how to appoint their staff, and to control them by allocating to them their work in such a way as to get the best results. Instead of this, their aim has been to get what they call an "all-around" man, and thus try to shift the responsibility off their shoulders. Owing to the confusion existing in the minds of such unskilled persons as to the proper administration of gold mines, the work of the different departments has often become hopelessly mixed. By these persons the manager is expected to be a geologist, a miner, a mechanic, a chemist and a business administrator, all rolled into one; but evidently this leads to failure. Pseudo-geologists, or prospectors without adequate knowledge, have been often employed to survey and report on the properties.

Incapable persons also have been entrusted to do the industrial part of the work of mining, milling, and saving the gold. All this blundering results in heavy loss. So largely has this been the case from the earliest times, that those who have taken the trouble to enquire into the facts, taking good and bad mines alike, have often made the statement that gold costs more to produce than it is worth. Proper geological surveys, not only of the gold-bearing veins or beds, but of the enclosing rocks, must now take the place of the old prospector's empirical work in order to prepare the field for the tools of the workers of the mines, who cannot otherwise proceed intelligently with their operations. The costs of preliminary and concurrent surveys by competent geologists should always be provided for in any gold mining scheme. The expense of such surveys will be infinitesimal, compared with the money thrown away in times past on many expensive, abortive, El Dorado-like schemes.

The mining operations should be under the control of an educated and experienced mining superintendent. He must be a practical miner, and should have had experience in mining various ores in different parts of the world. It is a great disadvantage to employ a miner whose prejudices have been developed by long experience in one particular series of rocks or of the physical structure of one country. Such a man, however capable otherwise, has no resources when he comes to deal with new geological conditions. Unfortunately, many good mines have been condemned by such men. The various methods of gold mining naturally depend on the formation of the gold bearing rocks. The operations often reveal sections of the earth's crust, which when noted by the thoughtful geologist, lead to further following up of the payable deposits; if, however, these sections are left unnoticed and unrecorded, rich opportunities are thrown away.

Having "torn up the mountains by the roots," as mining was described in the book of Job, and brought the ore "to grass," the next operation is to mechanically crush it, in order to free the gold from the gangue; there is no evidence of this operation having been attempted by the ancients. The stone-breakers, mechanical hammers and various crushing appliances of all kinds do on an artificial scale what the earth's movements, the sea, ice, frost and rivers have always done with the rocks on a natural scale. The Californian stamp mill for crushing the ore is an improvement in detail and adaptability on the old Cornish mill used in tin stamping, which has been in vogue since the seventeenth century. By the stamp mills, which are at present the chief means of crushing, the ore is reduced to a fine state of sub-division, and the battery is flushed with water to act as a carrier of the finely divided ore or pulp from under the hammers. This pulp is carried over plates coated with mercury, which catches a certain amount of gold, and so saves it in the form of an amalgam of gold and mercury. The general result of this treatment is great loss in float gold, and loss of gold in slimes. A newer method, which is now attracting much attention, but may not be applicable to all kinds of ores, is to crush the ore dry, and this makes the product easier to deal with, when a percolation chemical process is used for dissolving the gold out of the ore, instead of taking it out by amalgamation with mercury.

It has been the aim of this paper to show that the chance of men finding much gold in massive nuggets, and becoming suddenly rich, has for ever vanished. To continue the necessary supply of gold, to carry on the ever-extending commerce of the world, a vast industry of the first importance, aided by many sciences, is needed to gather out the infinitely small scattered portions of gold as they exist in nature. The product in gold of the industry which has recently sprung up will afford relief to the straitened currency of the world; and as it can now be procured with the industrial and scientific certainty predicted by Jevons, the result to the world will in the near future be very great. The governor and directors of the Bank of England may hold the key of the bank's gold, but the geologists hold the golden key of knowledge to the earth's store-houses of the kingly metal, and although it cannot be counted up like gold in the bank, they, and they only, can be relied on to survey the new gold-fields which may yet be found. If this be done, the still potent survivals of mediæval or Oriental superstitions, ever ready to delude again and again a too gullable public, will