

gold, and likely to occur in the interior parts of our rocks, are ferrous sulphate of iron, organic matter, and metallic sulphides. These also reduce silver from certain of its solutions, but, as already noted, the difficulty is in finding a substance which will reduce these two metals simultaneously in coherent forms, and from such kinds of solutions as generally permeate our rocks. With this double duty to perform, and limited in this manner as regards nature of solvent, I cannot avoid thinking that but one of these reducing agents, the metallic sulphides, will be found equal to the occasion. The ferrous sulphate is thrown out at once from this service on account of its insolubility in such a menstruum, while organic matter appears to have a decided tendency to scatter the gold it reduces (see Art. LII), nor have we, as far as I am aware, produced any true alloy of gold and silver by their use.

I would not intend to convey the idea that such a mixed deposition is impossible, but only that, from what we at present know of this subject, the production of such an alloy by these means appears a very difficult undertaking. However, this particular question is, I understand, now being dealt with by Mr. Daintree, late assistant geologist to the Victorian Geological Survey,* so that the propriety or otherwise of retaining this theory of the origin of our auriferous deposits in their lodes by the interaction of organic matter may be left in abeyance until Mr. Daintree publishes the results of his inquiry, as promised.

I will therefore leave the question in this state, merely observing that should Mr. Daintree be unable to obtain the results he is in search of, I shall then claim for our metallic sulphides the sole duty of depositing at least that portion of our native gold which occurs in the reefs or fissures of our metamorphic rocks.

ART. LII.—*Critical Notes upon the Alleged Nuclear Action of Gold upon Gold reduced from Solution by Organic Matter.* By W. SKEY, Analyst to the Geological Survey of New Zealand.

[Read before the Wellington Philosophical Society, 23rd October, 1872.]

IN a paper upon the formation of gold nuggets which appeared in Part I., Vol. VIII., of the *Transactions and Proceedings* of the Royal Society of Victoria, the author, Mr. C. Wilkinson, states in reference to the question as to the origin of gold nuggets that "Mr. Daintree, formerly of our Geological Survey (that of Victoria) had on one occasion prepared for photographic use a solution of chloride of gold, leaving in it a small piece of metallic gold

* "Athenæum," 22nd July, 1871.

undissolved. Accidentally some extraneous substance, supposed to have been a piece of cork, had fallen into the solution, decomposing it and causing the gold to precipitate, which deposited in the metallic state, as in the electroplating process, around the small piece of undissolved gold, increasing it in size to two or three times its original dimensions."

The results alleged to have been obtained by Mr. Daintree appearing to have, and indeed being recognized as having, a very important bearing upon the popular question as to how our gold nuggets have been formed I have endeavoured to obtain further details, but in this I have been unsuccessful. Mr. Brough Smyth, indeed, in his work upon the Gold Fields and Mineral Districts of Victoria, refers to what appears to be the same experiment, but nothing further is there stated except that the size of the gold fragment started with is increased from a "speck" to a "piece." I have therefore tried to reproduce the results themselves, and having been unsuccessful I will describe minutely the several modes I adopted.

1st. .1315 grammes of gold, hammered thin and bent to a curved disc of such a size as to expose about half a square inch of superficies, was placed in a glass vessel containing two ounces of a solution of auric-chloride of a strength equal to half a grain of gold per ounce. For reducing agents small pieces of cork and wood were sunk by glass attachments to the bottom of the vessel in close proximity to the disc of gold.

The vessel was then closed, put in a darkened place, and suffered to remain at rest until all the gold present in solution had been reduced, a process occupying in this case a period of time equal to rather more than two months.

The gold disc was then carefully examined and weighed. It had a small quantity of very finely granular gold loosely adherent to it, and apparently equally disposed over its surface.

With the whole of this loose gold attached the disc only increased in weight .0005 of a gramme, or $\frac{1}{263}$ of its weight (a rate of increase that would require about forty-four years to double the size of the disc), consequently only about the $\frac{1}{130}$ part of the total amount of gold present in solution had deposited upon the disc, the remainder having deposited away from it, and this was seen to have indiscriminately attached itself to every surface which had contact with the auriferous solution, whether the bottom or sides of the vessel, the glass attachments, or even the surface of the liquid having contact only with the atmosphere.

In reference to the minute quantity deposited upon the gold disc it was found by numerical calculation that the proportion was certainly not more, relatively to the surface of the disc, than that which the remainder of the gold bore to the extent of the surfaces upon which it had affixed itself.

2nd. The same experiment repeated, but vessel and contents not darkened. Same results as before.

3rd. Gold solution reduced to half its strength, and time of total deposition extended to four months. Diffused sunlight admitted.

4th. Soluble organic matter used in place of wood; sunlight excluded. Time of total deposition of gold two months.

No discernible difference in results upon point in question to those obtained in experiment No. 1.

So far, therefore, as is shown by these results gold reduced from solution of its chloride by aid of such kinds of organic matter as cork or wood, does not in the manner of its deposition exhibit such a notable selective power for metallic gold as the description of Mr. Daintree's results would lead us to suppose. It does not, indeed, show any such selective process at all, that is to a greater extent than can be attributed to the action of surfaces generally regardless of their nature; and in support of this, I believe I am correct in stating that the whole sum of our experiences (omitting those of Mr. Daintree) is directly against this theory, as to the rapid and marked deposition of gold on gold in the manner stated; indeed, so far as I am aware, we only produce by these means fine incoherent powder—minute crystals or films of exceeding thinness—nothing nuggetty. We get a certain size of grain or crystal or a certain thickness of film, which our efforts have hitherto failed to enlarge.

Our experience therefore on this point being in such opposition to that of Mr. Daintree quoted above, and which he quiescently allows to be imputed to him, and the subject itself being a most important one, it does seem that the data upon which these apposite statements are founded should be ample, of a definite character, and clearly stated; but so far it does not appear by any means certain, from all I am able to gather on the subject, whether there was in reality any notable deposition of gold on the undissolved residue of gold, and if so, whether the reduction of this gold was solely effected by agency of organic matter. Thus Mr. Wilkinson states, "Accidentally some extraneous substance, supposed to be a piece of cork, had fallen into the solution, decomposing and precipitating the gold." Here then we are led to suppose that the vessel containing the solution, etc., was not closed. What, therefore, might not be reasonably supposed to have fallen in besides cork, or any other kind of organic matter? Pyritous dust, or even a small nugget of this substance, might have accidentally fallen in this solution, splintered off from some specimen which perchance Mr. Daintree himself might have been examining; pyritous matters generally being able, as I have shown, to reduce gold from such solutions, and to deposit it indefinitely upon gold or other electric conductor. Unless precautions had been taken, therefore, to prevent the introduction of reducing agents other than those coming under

the description of organic matter, it is impossible to credit the latter with producing the phenomena described. But granting that nothing except organic matter was administered to the solution, even then the evidence as to the enlargement of the "piece of undissolved gold" is exceedingly unsatisfactory.

Thus it appears from the manner of stating the matter that neither the weight nor volume of the "undissolved gold" was determined, the apparatus, etc., evidently not being arranged for any experimental inquiry at all. If then no such determinations were made at the outset, they would be of no value as applied to the piece of gold after the process of decomposition was complete. Consequently the statement that the undissolved gold was increased two or three, or several times, its volume, as Mr. B. Smyth states, is guess-work, for the correctness of which we are dependent upon the power of the eye to realize size, the power of the memory to retain a correct and distinct impression as to the size and shape of the gold piece at the outset, and further upon the proper working of the comparative faculty, in order that this image in the memory may be correctly compared with that which the enlarged nugget presented to the eye when the process was finished.

Obviously so many delicate processes are involved in this method of estimating size, that the results given cannot properly be taken as being absolutely correct, nor yet even to have such weight as to induce us to forego our present belief in the dispersion rather than the aggregation of gold precipitating from solution under the circumstances stated.

In the meanwhile, in cognizance of the tendency of gold to scatter when reduced from solution by organic matter, as manifested by my experiment here described, and by our previous experience in this matter, and on the other hand its tendency to agglomerate when reduced from solution by metallic sulphides, I cannot allow Mr. Daintree's results, as at present known to me, to affect me in any speculations I may make as to the origin of gold nuggets in drift.

ART. LIII.—*On the Absorption of Certain Alkaloids by Aluminous Silicates.*
By W. SKEY, Analyst to the Geological Survey of New Zealand.

[Read before the Wellington Philosophical Society, 23rd October, 1872.]

If an aqueous solution of strychnia is agitated a short time with common clay it will be found on testing the mixture that a part or the whole of the alkaloid (according to the quantity used) has been removed from solution and absorbed by the clay. The same effects follow when the clay is