

it is simultaneously with the production of an electric current at the seat of action. In regard to this, we have seen that in our metallic sulphides as associated with auriferous solutions we have the means for producing electric currents—that is, electrolytic action; but, except in the case of our deeper-seated reefs, we do not get these sulphides, and, as in contact with the gold of our drifts we only get it rarely, therefore the question we have is this: Does there exist a general agency in these drifts for the production of electric currents in or in juxtaposition to the gold of these drifts? This question that I have just worked up, and in such a way as to incorporate here the historical facts above stated, I shall endeavour to answer, and in the affirmative. I shall, as I think, show that there are in these auriferous drifts generally the means whereby the electro-deposition of gold on gold can be accomplished, and this in a general, a natural way; and I shall also endeavour to show what these means are.

Now, it is on record\* that in 1876 I communicated to this society a knowledge of the fact I had just then discovered, that electrical currents are generated by platina when paired with graphite in alkaline and also in saline solutions; a fact that, by the way, I afterwards found had just a little prior to this time been announced both by Professors Becquerel and Gauguin† in publications to which I had not access for years afterwards. At that time I attributed these currents to chemical action at the surface of the platina, and not to a mere polarisation of the metal, as Professor Becquerel maintained. Thoroughly believing my view of the case to be correct, it occurred to me, in view of the question before us, to carry my investigation of the subject far enough to ascertain whether any of our noble metals do give, in alkaline solutions, electric currents sufficiently strong and persistent to decompose acid solutions of gold and deposit the metal in the form in which we find it in our auriferous drifts. For my first—my tentative—experiment I made choice of platina as the metal that, if it did give me any results at all, would exhibit them with unmistakable clearness. Thoroughly cleaning a wire of this metal in suitable acids, I waxed it to within  $\frac{1}{2}$  in. of each extremity, and then plunged one end of it in a weak solution of caustic potash, and the other end I placed in a very weak solution of auric chloride, making the interpolar connection between the two vessels containing these solutions with stiff gelatine in a U-shaped glass tube, when, after the expiration of four hours, I found the platina wire was gilded up to the waxed part, while in twenty-four hours all the gold of the solution had been electro-deposited on the platina wire. The gold was in the highest degree solid, lustrous, and reguline.

This was very encouraging, so I at once continued the investigation by experimenting upon gold, and the results of this I herewith state as shortly as I can, and in the order that I obtained them:—

1. When pure gold in weak or strong solutions of an alkali is electrically connected with gold in a weak solution of the terchloride of that metal a deposit of gold (out of the metallic solution) upon the gold therein occurs, and this gold is both lustrous and coherent.

2. When the ordinary acids, such as hydrochloric, sulphuric, and acetic acids, also the neutral salts generally, are substituted for the alkali the same effects are produced, but at a much slower rate.

3. Common spring water and distilled water may be substituted for the acids with similar but, of course, far less pronounced effects.

4. The same results as those above stated are also to be obtained if the solution of gold is feebly alkalized with an alkaline bicarbonate.

5. No such deposit occurs if the auric chloride or bicarbonate is replaced by an alkaline aurate.

6. A large sheet of gold in the auric chloride, coupled with a small sheet of gold in the same solution and of the same strength, deposits gold on the small sheet.

7. With gold in a weak solution of the auric chloride, as against gold in a strong solution of this salt, this metal is precipitated on the gold in the strong solution.

8. If gold or platina in auric chloride be connected with platina or gold that is in good contact with any ordinary soil it receives a deposit of bright solid gold thereon in a few hours, while the metal that is in the soil becomes coated with a thin but continuous film of peroxide of iron in most cases.

9. Gold in an alkaline solution is electro-positive to gold in acid solutions generally.

In every case the gold or the platina that stood in the auric chloride solution was coated with wax to well below the surface of the liquid, to guard against any irregular deposit of gold brought about by differences in the surroundings of the metal.

It was proved that the gelatine used for the interpolar connections in these experiments had no part (by its deoxidizing properties) in the production of these metallic deposits.

These results, as a whole, show very clearly that gold can be nuclear to itself in the popular meaning of the term—that, in fact, it can either of itself, or assisted in some way that at present we do not understand, slowly build gold upon gold in that solid coherent form that our nuggets are in. They show, besides, that, whatever the means are by which this is produced, these will exist throughout all the drifts in which native gold occurs. Thus, any particle or nugget of gold lying in the bed, or partly in the bed, of a stream that contains gold in solution will certainly become coated with gold, and this because it is in such a position that the upper and lower surfaces of it are in a saline solution of a different nature, the water being acidic from the presence of free carbonic acid, while the sand and earth are more or less alkaline, the alkaline solution, as we have seen, being especially favourable to the liberation of gold from acid solutions of it. This liberation is a chemical act, and therefore is accompanied by an electric current, by which the gold is electro-deposited on the upper part of the particle or nugget of gold.

All this signifies that for the deposition of gold we have here there must be the “seed-gold,” or auriferous nuclei, to start with; but it is not necessary to go to the reef for this. In any strong proto-compound of iron or metallic sulphide, or even organic matter, we have in conjunction with

\* Trans. N.Z. Inst., vol. viii., page 332.

† Watt's Dic. Chemistry, 2nd supplement, page 444.