The above results appear to indicate that the conditions of Experiment 8 are to be preferred. To confirm this a series of ten determinations were made in accordance with those conditions, namely, 25 cc. of copper sulphate solution, representing 0.2533 gram of metallic copper, 25 cc. of the standard sulphuric acid, .5 gram of potassium nitrate, 4 amperes, 10 volts at the outset, r 17 volts at the end of reduction, slowest speed and thirty minutes. The dish was not warmed at the outset of the experiment, or was external heat applied during electrolysis, although the liquid was considerably heated by the current, the final temperature being about 65° C. This continuous series was made in a single afternoon and no results were rejected; consequently they may be taken as representing the probable error of the method.

The following are the percentages of nitrogen found, the theoretical value being 13.86:

Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
13.81	13.79	13.83	13.83	13.94
13.86	13.92	13.92	13.86	13.89

Mean of the series of ten, 13.865.

This method for nitrates compares quite favorably with other methods in point of accuracy. Its advantages in simplicity and speed appear to the writer to be worthy of careful consideration, as a complete determination of the nitric acid content of an alkali litrate may be made in thirty-five minutes from the time of beighing off the sample.

The applicability of the method to other nitrates than that of potassium will be studied.

CONTRIBUTION FROM THE JOHN HARRISON LABORATORY OF CHEMISTRY, No. 85.]

DETERMINATION AND SEPARATION OF GOLD IN THE ELECTROLYTIC WAY.[1]

BY SARAH P. MILLER.

Received July 26, 1904.

The purpose of this investigation was to ascertain the conditions under which gold could be satisfactorily deposited from its solu-on:

(*a*) in potassium cyanide;

(*b*) in the presence of phosphoric acid;

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[1] From the author's thesis for the Ph.D. degree.

(*c*) in sodium sulphide;
and to employ the data thus gathered for its separation fro
various other metals.

(A) DETERMINATION IN CYANIDE SOLUTION.

To 10 cc. of auric chloride were added 1 gram of potassiu cyanide and 150 cc. of water. The precipitated gold was perfectl adherent and was deposited directly upon the sides of the platinu dish in connection with the cathode.

RESULTS.

Gold present.	Potassium cyanide.	Dilution.	Current.	Volts.	Temperature.	Time.	Gold found.
Gram.	Gram.	cc.	N.D$_{100}$ =		°C.	Hour.	Gram
0.1275	1.0	150	0.15–0.20 A	3.0–3.7	65	1	0.127
0.1275	1.0	150	0.20–0.30 A	3.5–4.0	65	1	0.127

With the view of separations that might possibly be made, series of experiments were next carried out, employing the sam electrolyte as prevailed in the above determinations, but using current of low pressure and strength, in order to obtain condition under which the lowest possible pressure and current strengt could be applied and yet completely precipitate the gold from it solution.

The temperature best adapted for the deposition of the met ranged between 55° C. and 65° C. In the cold the gold was n deposited so rapidly, and, in fact, with the lowest amperage an voltage employed it was not precipitated at all. A temperatur above 75° C. also prevented its deposition to some extent.

The results were as follows:

Expt. No.	Gold present.	Potassium cyanide.	Dilution.	Current.	Volts.	Temperature.	Time.	Gold found.
	Gram.	Gram.	cc.	N.D$_{100}$ =		°C.	Hours.	Gra
1	0.1291	1.0	150	0.07–0.09 A	1.8–2.0	75	2½	0.12
2	0.1291	1.0	150	0.04–0.06 A	1.8–2.0	68	2½	0.12
3	0.1291	1.0	150	0.02–0.15 A	1.8–2.8	60	2	0.12
4	0.1291	1.0	150	0.03–0.20 A	2.0–3.0	65	2½	0.12
5	0.1291	1.0	150	0.11–0.04 A	2.5	61	2	0.12
6	0.1291	1.0	150	0.03–0.02 A	1.8	70	2½	0.12
7	0.1291	1.0	150	0.04–0.02 A	1.8	65	2½	0.12

In Experiments 1, 2 and 3, tabulated above, a current of $N.D_{100} = 0.015$ ampere and 1.6 volts were allowed to act upon the solution for one hour; at the expiration of that time no gold had been precipitated.

It was also found that a current of $N.D_{100} = 0.02$ ampere and 1.8 volts, although sufficient to give a deposition of gold, failed to bring down the last traces. This was demonstrated by subjecting the solution to those conditions for three hours, and then raising the level of the liquid. After one hour, there being no further precipitation of metal, the liquid was siphoned off, the electrolyte replaced by water, the current interrupted and the deposit weighed after washing with hot water, alcohol and ether and drying in a desiccator. Instead of 0.1291 gram of gold present there was obtained (*a*) 0.1260 gram and (*b*) 0.1259 gram of metal.

As shown, however, in Experiments 6 and 7, a current of 1.8 volts with 0.02-0.04 ampere for one and one-half hours, then increased so as to maintain a voltage of 1.8, allows of the complete precipitation of the gold.

The method of treating the deposits of metal, as outlined above, was adhered to in all experiments, unless otherwise stated. And in all cases (unless special treatment is cited) the gold was deposited directly upon the platinum, and after weighing dissolved off by introducing very dilute potassium cyanide (0.5 gram in 150 cc. of water) into the dish, and connecting the latter with the anode of a battery yielding a very feeble current (0.2 ampere and 5 volts), using a copper wire in connection with the cathode.

RATE OF PRECIPITATION OF GOLD FROM DOUBLE CYANIDE SOLUTION.

In a series of experiments made to determine the rate of precipitation of gold from its double cyanide, a solution containing 0.1236 gram of gold, 1 gram of potassium cyanide and diluted to 125 cc. was acted upon by a current of $N.D_{100} = 0.03$ ampere and 2.5 volts. The electrolyte was warmed to 50° C. before subjecting it to the current.

After fifteen minutes there was no deposit of gold.

After thirty minutes the deposit of gold weighed 0.0006 gram.

After forty-five minutes the deposit of gold weighed 0.0030 gram.

After sixty minutes the deposit of gold weighed 0.0051 gram.

After seventy-five minutes the deposit of gold weighed 0.0083 gram.

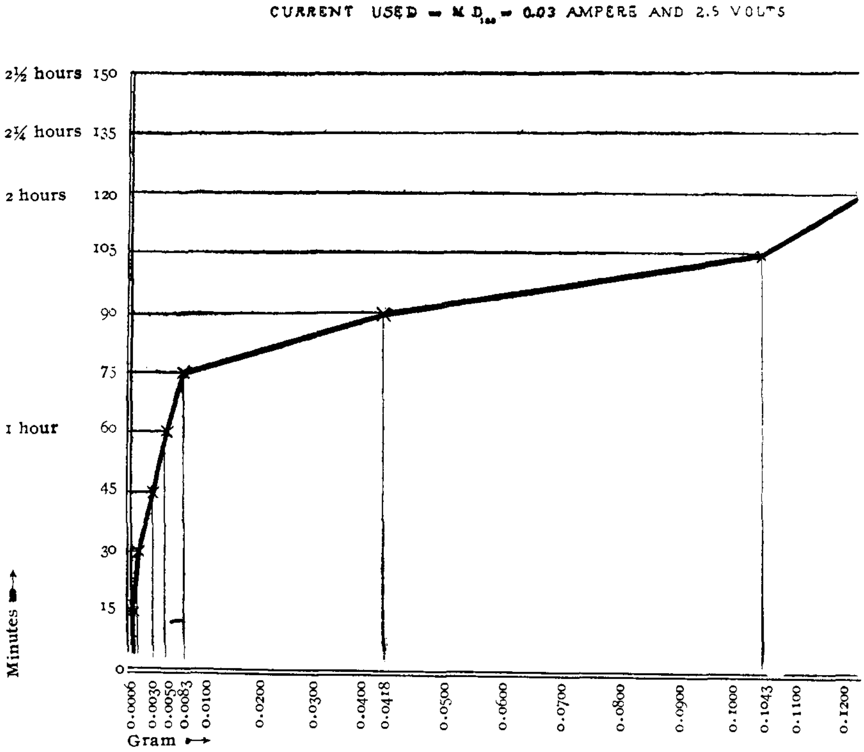
After ninety minutes the deposit of gold weighed 0.0418 gram.

Ater one hundred and five minutes the deposit of gold weighed 0.1047 gram.

After one hundred and thirty-five minutes the deposit of gold weighed 0.1236 gram.

After one hundred and fifty minutes the deposit of gold weighed 0.1236 gram.

CURVE SHOWING THE RATE OF PRECIPITATION OF GOLD FROM DOUBLE CYANIDE SOLUTION.



SEPARATIONS IN CYANIDE SOLUTION.

Among the metals, not as yet successfully separated from gold, may be mentioned, iron, cadmium, silver, lead and mercury.

Gold from Iron.

Ferrous ammonium sulphate was taken in sufficient quantity to yield 0.1300 gram of metallic iron, and dissolved in 10 cc. of water, filtered immediately into 3 grams of potassium cyanide, warmed and quickly filtered—this procedure insured the presence of all of the iron in the ferrous state. To this dark brown solution were added 10 cc. of auric chloride, containing 0.1286 gram of metallic gold, and the whole diluted to 125 cc.

RESULTS.

Expt. No.	Gold present. Gram.	Iron present. Gram.	Potassium cyanide. Gram.	Dilution. cc.	Current. $N.D_{100}$ =	Volts.	Temperature. ° C.	Time. Hours.	Gold found. Gram.
1	0.1286	0.1300	3.0	125	0.13–0.36 A	2.3–3.0	65	2½	0.1284
2	0.1286	0.1300	3.0	125	0.06–0.11 A	2.3–3.0	Cold	Night	0.1285
3	0.1286	0.1300	3.0	125	0.17–0.30 A	2.5–3.0	64	3	0.1285
4	0.1286	0.1300	3.0	125	0.11–0.12 A	2.2–3.0	Cold	Night	0.1284

By several experiments it was demonstrated that a current of $N.D_{100}$ = 0.05-0.11 ampere and 1.7-2.3 volts; other conditions, as previously given, failed to completely precipitate the gold, 0.1261 gram being found and 0.1286 gram being present.

In all four experiments cited above, the gold was completely precipitated from the solutions, and was free from iron.

Gold from Cadmium.

The separation of these metals in an alkaline cyanide electrolyte has never been recorded. A series of experiments with the most varying conditions was instituted, but resulted negatively. The accompanying diagrams express plainly the facts obtained in the many trials which were conducted.

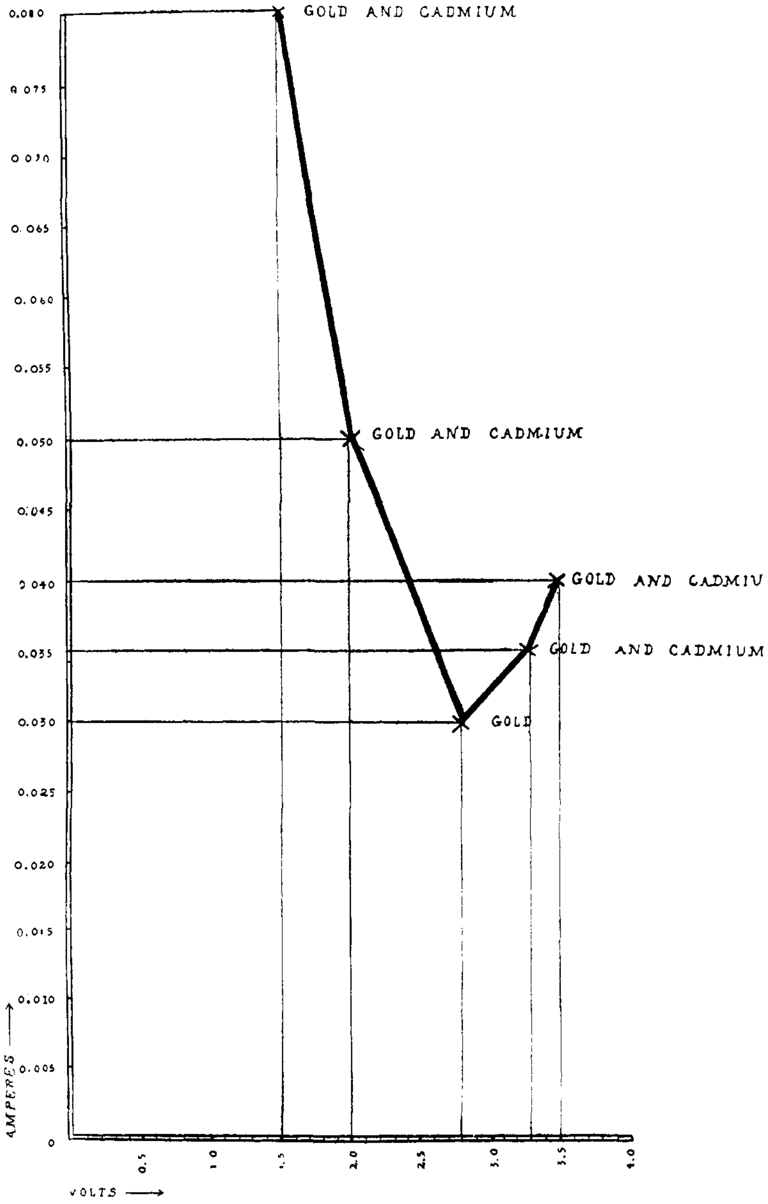
Gold from Silver.

A silver nitrate solution containing 0.1195 gram of silver to which had been added 1 gram of potassium cyanide and 2 grams of potassium hydroxide diluted to 125 cc. was subjected to the current.

An auric chloride solution containing 0.1667 gram of gold and 1 gram of potassium cyanide and 2 grams of potassium hydroxide, 125 cc. dilution, was similarly treated.

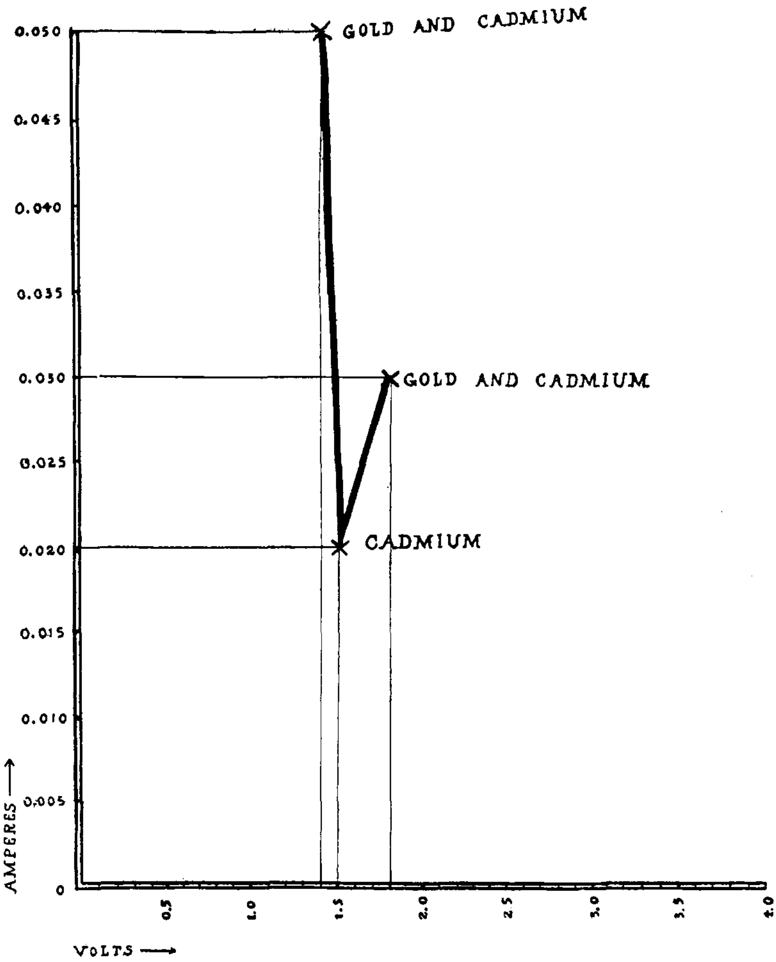
I.

HEATED TO 70° C



II

IN THE COLD



Silver alone (0.1195 gram).	Gold alone (0.1667 gram).
Over night (cold).	Over night (cold).
$N.D_{100} = 0.009$ to 0.015 ampere, and 1.6 to 1.8 volts	$N.D_{100} = 0.01$ ampere, and 1.6 volts
= 0.1190 gram of silver found.	= no deposit.
Heated to 45° to 50° C.	Heated to 45° to 50° C.
$N.D_{100} = 0.01$ to 0.02 ampere, and 1.5 to 1.75 volts	$N.D_{100} = 0.015$ ampere and 1.6 volts
= 0.1191 gram of silver found.	= no deposit.

With a current of $N.D_{100} = 0.025$ to 0.03 ampere and 2 to 2.5 volts, 0.1579 gram of gold was deposited.

With these facts as a basis, the separation of silver from gold was tried.

The problem resolved itself into the effort to obtain, as far as possible, a high current strength with a very low pressure. In order to obtain such a relation between current strength and pressure the electrodes were varied in these respects—as to their size relation and their distance apart, the electrolyte being changed in regard to proportions of potassium cyanide and caustic potash present.

The auric chloride used contained 0.1200 gram of metallic gold in 10 cc.; 2 grams of potassium cyanide; the silver nitrate, containing 0.1199 gram of silver; 2 grams of caustic potash; and this solution was diluted to 125 cc.

Experiment 1.—At 5 o'clock in the evening the above solution was subjected to the action of the current—$N.D_{100} = 0.02$ ampere and 1.5 volts. A perfectly white deposit began to appear almost immediately. The following morning the current registered 0.01 ampere and 1.4 volts—and there was no indication of any metal on the platinum dish serving as cathode.

Experiment 2.—The electrolyte was the same as in Experiment 1. The temperature of 45° C. was maintained. The current $N.D_{100} = 0.02$ ampere and 1.45 volts at first caused precipitation of metal. After fifteen minutes the current fell to 0.015 ampere and 1.3 volts, and the deposit which had formed was redissolved. The current was raised to 0.025 ampere and 1.5 volts and deposition of metal began. After two hours the level of the liquid was raised. There seemed to be no further deposition of metal; on raising the current to 0.03 ampere and 1.8 volts, however, more metal was precipitated. In one-half hour the current was interrupted (after first siphoning off the electrolyte and replacing it with water) and the usual procedure of treating the deposit carried out—when the deposit appeared uniformly light yellow in color. It weighed 0.1973 gram, the liquid was free from silver, hence 0.0774 gram approximately of gold had also been deposited.

Experiment 3.—The electrolyte was the same as was used in the two preceding experiments. The current was held at 0.015 ampere and 1.6 volts for two hours, when the deposit, after washing with warm water, alcohol and ether, and drying, was weighed. There had been precipitated 0.0935 gram of metallic silver (= 77 per cent. of silver present) absolutely free from gold.

Experiment 4.—The deposit which was obtained weighed 0.2003 gram and had a pale yellow color. The current at first was $N.D_{100} = 0.02$ ampere and 1.4 volts. After two hours this was increased to 0.025 ampere and 1.7 volts, and kept there for one-half hour. There was no indication of silver in the solution, so apparently 0.0804 gram of gold had also been deposited.

In another experiment with the final results similar to those of Experiments 2 and 4, the varying effects of temperature were demonstrated. In the cold a deposition of silver began with a current of 0.015 ampere and 1.45 volts. A uniform coating, white in appearance, covered the dish. One hour later this had entirely disappeared. Heat was applied when the deposit again appeared. In a short time it again disappeared, the temperature registering at this time 78° C. On cooling the solution the coating again appeared and remained with a temperature ranging from 45° to 55° C.

With all of the preceding trials a platinum dish of 175 cc. capacity was used as cathode, and a large platinum spiral of 7 cm. diameter as anode.

Varying amounts of potassium cyanide and caustic potash were tried: One gram of potassium cyanide; 2 grams of caustic potash; 3 grams of potassium cyanide; 2 grams of caustic potash; and 4 grams of potassium cyanide; 2 grams of caustic potash.

The results were the same in all cases; there was no separation. If a low enough current was used to yield silver free from gold, more than 80 per cent. of the silver was never deposited from its solution. When a current of sufficient strength to precipitate the last traces of silver was employed, varying amounts of gold were carried down with the silver.

Changes in the electrodes, and with each of these changes variations in the proportion of potassium cyanide to potassium hydroxide, were next tried, as follows:

A platinum dish of 175 cc. capacity was made the anode, a platinum gauze (5 x 10 cm.) the cathode. In other experiments the platinum gauze served as the anode and the dish as the cathode.

Two plates of platinum (5 x 10 cm.) were used: The one, in connection with the anode, was rolled and fastened with platinum wire; the other surrounded it, being equally distant from it at all points; a beaker held the solution into which the electrodes were introduced.

When all of the silver was precipitated, gold was invariably present. In some cases the deposit was perfectly white in color, but when treated with nitric acid, the silver would be shown to have been covering a layer of gold. Oftener, however, the deposit was of a very pale yellow color, when in response to treatment with nitric acid the gold would be seen as a thin film covering the silver. In a few cases it seemed probable that the two metals had been simultaneously precipitated and were in consequence intimately combined in the deposit.

The expedient of first coating the platinum used in connection with the cathode received attention; also varying the electrolyte as to relative amounts of cyanide and caustic potash present, and varying the electrodes as described above, but with no better results.

No success was attained in the attempts to separate gold from mercury in a cyanide solution, or in solutions containing both an alkaline cyanide and an alkaline hydroxide.

(B) DETERMINATION IN PHOSPHATE SOLUTION.

A solution containing 10 cc. of auric chloride (= 0.1286 gram metallic gold), 20 cc. of disodium hydrogen phosphate (sp. gr. 1.028) and 5 cc. of phosphoric acid (sp. gr. 1.35) was diluted to 125 cc., warmed to 65° C. before allowing the current to pass through; and electrolyzed with a current of $N.D_{100} = 0.07$ ampere and 1 to 2 volts. After one and one-half hours the level of the liquid was raised and the current increased to $N.D_{100} = 0.12$ ampere and 2.5 volts. There was no further deposition of metal.

The deposit was brown, and in washing with alcohol and ether some of it was detached. The current used had evidently been too strong.

Other experiments followed, using a lower current; in these the deposits, although more compact and adherent, warm water only being used for washing, were not of bright yellow color. Dark specks appeared on the deposits. In weighing them they were all found to be nearly 0.0008 gram too heavy.

The test made for phosphorus in the deposited gold failed to reveal its presence.

A solution of disodium hydrogen phosphate and free phosphoric acid was electrolyzed, but gave no deposit.

Gently igniting the dish containing the deposit, by passing it several times over a small flame of a Bunsen burner, gave a bright yellow deposit of gold.

A deposit weighing 0.0858 gram was thus treated and weighed 0.0847 gram after the first heating, 0.0846 gram after the second heating, and 0.0846 gram after the third heating. There was present 0.0849 gram of gold.

The gentle ignition, as observed from the three weighings, was not sufficient to volatilize any of the gold. The excess of weight of the deposit was probaby due to traces of organic matter in the disodium hydrogen phosphate or in the phosphoric acid.

RESULTS.

Expt. No.	Gold present. Gram.	Disodium hydrogen phosphate (sp. gr. 1.028). cc.	Phosphoric acid (sp. gr. 1.35). cc.	Dilution. cc.	Time. Hrs.	Temperature. ° C.	Current. $N.D_{100}$ =	Volts.	Gold found before ignit'n. Gram.	Gold found after ignition. Gram.
1	0.0849	20	5	125	2	60	0.02–0.015 A	1.0–1.8	0.0855	0.0847
2	0.0849	20	5	125	2	67	0.02 A	1.0–2.0	0.0857	0.0848
3	0.1196	20	5	125	3	60	0.03 A	1.0–2.0	0.1204	0.1197
4	0.1188	20	5	125	2	64	0.02–0.04 A	1.6–2.0	0.1196	0.1187
5	0.1188	20	5	125	2	60	0.02–0.03 A	1.0–2.0	0.1192	0.1185

In all of these precipitations the deposits were perfectly adherent and free from phosphorus, and after heating were of a bright yellow color.

SEPARATIONS IN PHOSPHATE SOLUTION.

Gold from Cadmium.

Cadmium sulphate containing 0.1107 gram of cadmium was used. In every case the solution was previously heated to 50°-60° C. before allowing the current to act upon the solution. Disodium hydrogen phosphate (sp. gr. 1.028) and phosphoric acid (sp. gr. 1.35) were used in amounts of 40 cc. of the former and 10 cc. of the free acid; 30 cc. of the first and 8 cc. of free phosphoric acid; and 20 cc. of disodium phosphate and 5 cc. of free phosphoric acid. The results seemed to be equally satisfactory; 20 cc. of disodium hydrogen phosphate and 5 cc. of phosphoric acid were most frequently used.

No cadmium or phosphorus was found in the precipitated gold, the deposits were perfectly compact and, after heating, bright in appearance. Warm water only was used in washing the gold precipitated from phosphate solution.

RESULTS.

Gold present. Gram.	Cadmium present. Gram.	Dilution. cc.	Temperature. ° C.	Time. Hrs.	Current. N.D$_{100}$ =	Volts.	Gold found after heating. Gram.
0.1188	0.1107	125	60	4	0.02-0.03 A	1.0-2.2	0.1190
0.1696	0.1107	125	65	4½	0.02 A	1.0-1.7	0.1697
0.1188	0.1107	125	55	5	0.02 A	1.1-2.0	0.1187
0.1448	0.1107	125	66	5	0.03 A	1.0-2.0	0.1450
0.1448	0.1107	125	66	4	0.02 A	1.0-1.8	0.1447

Gold from Iron.

Ferric ammonium sulphate was the salt used, containing 0.1100 gram of iron in 10 cc. Total dilution equaled 125 cc. The temperature was 52° C. Forty cc. of disodium hydrogen phosphate (sp. gr. 1.028), 10 cc. of free phosphoric acid (sp. gr. 1.35) and 0.1188 gram of gold were present.

The current acting upon the solution with a strength of N.D$_{100}$ = 0.03 to 0.06 ampere and 1.2 to 2 volts failed to precipitate the last traces of gold: (1) Gold found, 0.1163 gram; gold present, 0.1188 gram. (2) Gold found, 0.1168 gram; gold present, 0.1188 gram. (3) Gold found, 0.1155 gram; gold present, 0.1188 gram.

The solution was made more dilute, and the current increased, especially for the last half-hour. The results were then more satisfactory.

Expt. No.	Gold present. Gram.	Iron present. Gram.	Dilution. cc.	Time. Hours.	Temperature. ° C.	Current. N.D$_{100}$ =	Volts.	Gold found after ignition. Gram.
1	0.1188	0.1100	150	6	63	0.02-0.16 A	1.0-3.6	0.1182
2	0.1188	0.1100	150	6	67	0.02-0.17 A	1.0-3.0	0.1190
3	0.1188	0.1100	150	5	62	0.02-0.08 A	1.0-2.7	0.1189
4	0.1188	0.1100	150	5	62	0.02-0.08 A	1.0-2.7	0.1189
5	0.1188	0.1100	150	5	62	0.02-0.08 A	1.0-2.5	0.1187
6	0.1188	0.1100	150	5	63	0.02-0.10 A	1.0-2.7	0.1185

In Experiments 1 and 2 the gold was not perfectly adherent. The current strength was lowered and in Experiments 3, 4 and 5 the deposit was perfectly adherent, of a bright yellow color after heating, and was free from iron and phosphorus.

Gold from Zinc.

Zinc sulphate (= 0.1150 gram of zinc) and 10 cc. of auric chloride, 30 cc. of disodium hydrogen phosphate (sp. gr. 1.028), and 6 cc. of phosphoric acid (sp. gr. 1.35) were diluted to 150 cc. and electrolyzed.

RESULTS.

Gold present. Gram.	Zinc present. Gram.	Time. Hours.	Temperature. ° C.	Current. $N.D_{100}$ =	Volts.	Gold found after heating. Gram.
0.1148	0.1150	3½	66	0.03 A	1.8–2.0	0.1151
0.1148	0.1150	3	61	0.03–0.04 A	1.0–2.0	0.1145
0.1117	0.1150	2	69	0.03–0.05 A	2.0–2.5	0.1113
0.1117	0.1150	2	69	0.03–0.05 A	2.0–2.5	0.1114
0.1117	0.1150	2	67	0.04 A	2.0–2.5	0.1115

Zinc was not found in the precipitated metal.

Gold from Cobalt.

It was discovered, after repeated experiments, that the separation was effected more satisfactorily in rather dilute solutions. Accordingly, a solution of auric chloride, 30 cc. of disodium hydrogen phosphate (sp. gr. 1.028), 6 cc. of phosphoric acid (sp. gr. 1.35) and cobalt nitrate, containing 0.1200 gram of cobalt, was diluted to 150 cc. to 200 cc. and electrolyzed.

RESULTS.

Gold present. Gram.	Cobalt present. Gram.	Time. Hours.	Temperature. ° C.	Current. $N.D_{100}$ =	Volts.	Gold found after heating. Gram.
0.1219	0.1200	2½	53	0.03–0.04 A	1.2–2.0	0.1216
0.1219	0.1200	4	55	0.04 A	1.2–2.3	0.1214
0.1219	0.1200	3	60	0.03–0.04 A	1.1–2.0	0.1217
0.1237	0.1200	2½	78	0.03 A	0.8–1.8	0.1235
0.1237	0.1200	3	58	0.04–0.08 A	1.1–2.2	0.1238
0.1237	0.1200	2	66	0.04 A	1.1–2.0	0.1236
0.1237	0.1200	2	62	0.03–0.06 A	1.1–2.0	0.1239
0.1237	0.1200	2	58	0.03–0.05 A	1.1–2.0	0.1235

Cobalt was not precipitated.

Gold from Nickel.

A solution of 150 cc. volume containing 0.1200 gram of nickel as nitrate, 40 cc. of disodium hydrogen phosphate (sp. gr. 1.028), 6 cc. of phosphoric acid (sp. gr. 1.35) and 10 cc. of auric chloride, containing 0.1236 gram of gold, was electrolyzed with the following results:

Gold present. Gram.	Nickel present. Gram.	Temperature. °C.	Time. Hours.	Dilution. cc.	Current. $N.D_{100} =$	Volts.	Gold found after heating. Gram.
0.1236	0.1200	55	4	150	0.04–0.07 A	0.8–2.4	0.1232
0.1236	0.1200	68	4	150	0.04–0.06 A	1.0–2.2	0.1236
0.1236	0.1200	62	3	175	0.03–0.06 A	1.0–2.0	0.1239
0.1236	0.1200	60	2	175	0.03–0.06 A	1.0–2.0	0.1233

The gold deposited showed no trace of nickel.

Gold from Copper.

The electrolyte consisted of copper sulphate (= 0.1200 gram of copper), 40 cc. of disodium hydrogen phosphate (sp. gr. 1.028), 10 cc. of phosphoric acid (sp gr. 1.35) and 10 cc. of auric chloride (= 0.1188 gram of gold). Dilution, 125 cc.

A current of $N.D_{100} = 0.03$ ampere and 2 volts acted on the above solution in the cold through the night. The deposit weighed 0.2047 gram, 0.1188 gram of gold being present. Copper was present with the gold.

In a second trial, using the same electrolyte as above, but a current of $N.D_{100} = 0.02$ ampere and 1 volt, with a temperature of 54° C., after three hours the deposit weighed 0.1112 gram of gold free from copper, 0.1188 gram of gold being present. This same current, however, failed to bring down the last traces of the gold from its solution.

In all precipitations of gold from acid phosphate solution a platinum dish of 175 cc. to 200 cc. capacity was used in connection with the cathode, a platinum spiral with the anode. The depositions were washed only with cold and warm distilled water after siphoning off the liquid and replacing it with water. They were also heated gently either by passing the dish several times over a small flame of a Bunsen burner or by placing the dish on a warm iron plate.

(c) DETERMINATION IN SODIUM SULPHIDE SOLUTION.

A solution of 150 cc., in which were 0.1276 gram of gold, and 15 cc. of sodium sulphide (sp. gr. 1.19), heated to 61° C., was electrolyzed with a current of 0.1 ampere and 0.1 to 0.2 ampere, and

2.4 to 3 volts. In two hours there was deposited (1) 0.1272 gram, and (2) 0.1277 gram of gold.

To the auric chloride were added 50 cc. of water, then the sodium sulphide and the solution warmed carefully until it became clear, and finally diluted to 150 cc. and electrolyzed. The deposited gold was perfectly adherent, and of a shining yellow color, appearing like polished metal.

The separation of gold from arsenic, molybdenum and tungsten may be effected by observing the conditions given for the determination of gold from its sodium sulphide solution.

Separations of gold from mercury and tin were not effected.

[CONTRIBUTION FROM THE JOHN HARRISON LABORATORY OF CHEMISTRY, No. 86.]

THE USE OF A ROTATING ANODE IN THE ELECTROLYTIC ESTIMATION OF ZINC.[1]

BY LESLIE HOWARD INGHAM.

Received July 26, 1904.

THE purpose of the present investigation was to ascertain how rapidly the metal zinc could be electrolytically precipitated with the aid of a rotating anode.

The electrolytes employed were solutions of zinc in the presence of sodium hydroxide, sodium acetate. sodium formate and potassium cyanide.

The rate of precipitation of zinc from each of the electrolytes was also studied, after which experiments were instituted to discover how quickly the content of metal in zinc blende could be estimated. It is believed that these experiments indicate which electrolyte is preferable in each case, and demonstrate conclusively that the electrolytic procedure for the estimation of zinc is preferable to the ordinary gravimetric or volumetric methods.

The Apparatus.—The depositions were made upon platinum dishes of the usual form. The anode was a platinum wire 1 mm. in diameter, bent into a spiral 2 inches in diameter. The plane

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[1] From the author's thesis presented to the University of Pennsylvania for the Ph.D. degree.