

Boulder co., Colo., and he was desirous of knowing if the association had any peculiar significance.

In connection with the presence of manganese with the gold, Mr. Pearce suggested a theory as to the way in which the gold might have been deposited, namely, that sulphuric acid, arising from the oxidation of pyrite, on coming in contact with the peroxide of manganese in presence of water carrying chloride of sodium in solution, would cause a liberation of chlorine, which would attack any gold in the neighborhood, forming a soluble chloride from which the gold would be precipitated upon meeting ferrous sulphate at some other level.

MEETING OF MARCH 3D, 1884.

The Rev. H. Martyn Hart described a visit to Iceland undertaken some years ago at the request of the British Government, with the object of reporting upon certain alleged sulphur deposits, which he found to have no commercial value.

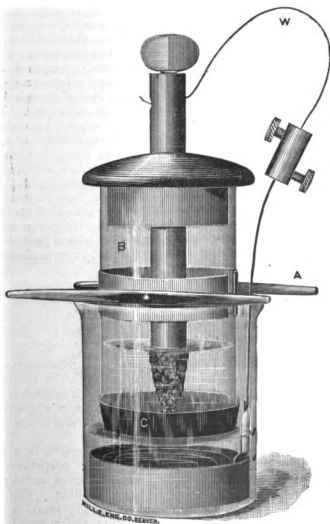
MEETING OF APRIL 7th, 1884.

New Apparatus for the Estimation of Copper, BY A. H. LOW

The following apparatus was devised as the result of a great many experiments undertaken with a view of simplifying the battery process for the electro-deposition of copper in analytical work. It possesses the merits of simplicity and rapidity of action, requiring much less care than a battery, and depositing the copper in good reguline condition in about one-third the time.

It consists of a small beaker, about one and three-quarter inches in diameter on the bottom and two and one-half inches high, in which is suspended by means of the support *A*, a stout glass tube *B*. This tube is open at both ends. The lower end is ground slightly conical on the outside and is fitted with a heavy silver ring *C*, also made conical to correspond with the tube. This ring serves to keep in place a parchment-paper diaphragm stretched across the end of the tube. The upper end of the tube is provided with a stopper through which passes a zinc rod reaching nearly to the bottom. A groove is cut on the side of the stopper to permit escape of gas. On the bottom of the beaker rests a platinum electrode consisting of a circular base, as large

as the beaker will permit, supporting a series of concentric walls about one-half an inch high. *D* is a platinum wire extending up out of the beaker. There is attached to its



lower end, where it joins the body of the electrode, a piece of platinum foil reaching up a short distance, to increase the depository surface and prevent a powdery deposit on the

wire. The entire electrode is made of thin platinum foil soldered with gold. It weighs about eight grammes, and exposes (including both sides) about twenty square inches of surface. The tube-support *A* is made of thin iron and consists of a spring-ring nearly encircling the tube and two horizontal arms attached to the sides of the ring and resting on top of the beaker. The parchment-paper diaphragm on the bottom of the tube is prepared and mounted as follows :—take stout parchment-paper and cut discs from it large enough to cover the end of the tube and extend over about one-quarter of an inch on all sides. Two of these discs, wetted and superposed, are placed across the end of the tube. The latter is now pressed down into the ring resting upon a flat surface, and the whole is then inverted and the ring is driven securely into place with a small hammer or mallet, so as to form a water-tight joint.

About one minute is required for the entire operation, and a diaphragm thus fitted will last for several determinations. The zinc rod passing through the stopper must be amalgamated with mercury, and a short wire is provided to connect the zinc with the wire *D* of the platinum electrode

USE OF THE APPARATUS.

The solution from which the copper is to be deposited must always be of about the same nature when ready for electrolysis. It must be slightly acid with sulphuric acid and contain dissolved about three grammes of chlorate of potassium. It should stand at a depth of about three quarters of an inch in the beaker.

Ordinarily, one gramme of an ore is treated in a small flask with a mixture of five or six cubic centimetres of strong nitric acid and three cubic centimetres of strong sulphuric acid and heated until the latter is boiling. The flask and contents are then cooled, and after addition of a little water, boiled again to effect the solution as far as possible of any anhydrous sulphate of iron that may have separated and which might hold copper. To remove silver, if present, two drops of strong hydrochloric acid are added and the

liquid is filtered from the chloride of silver and gangue. Owing to the strong heat previously applied, any sulphur present will be in the form of yellow globules free from copper. The bulk of the solution must be kept as small as possible. To the filtrate are added three grammes of powdered chlorate of potassium, roughly weighed or measured, and then sufficient strong ammonia water to nearly neutralize the acid present. The necessary amount may be determined beforehand by actual trial with three cubic centimetres of sulphuric acid diluted with water, so as to save time and trouble at this point. The ammonia warms the liquid and causes the chlorate of potassium to dissolve. The electrode should be put in place and used as a stirrer. The liquid is now diluted until it stands at a depth of one-quarter of an inch above the electrode, or three-quarters of an inch deep in all. The solution is now ready for electrolysis. Dilute some strong sulphuric acid with four parts of water and pour this mixture into the glass tube to the depth of about an inch. Insert the zinc rod, and, having placed the tube and holder in position in the beaker with the diaphragm not touching the liquid, connect the zinc with the wire *D* of the platinum electrode.

Now slide the glass tube down through the holder until the diaphragm just touches the surface of the copper solution. The deposition of the copper begins at once and is finished in from one to two hours, according to the amount of copper present. The apparatus requires but little watching. It is well to occasionally raise and lower the platinum electrode slightly to keep the solution well mixed, and toward the end of the deposition, if the solution becomes very warm, as it occasionally does from various causes, the beaker must be set in water to prevent too great an elevation of temperature, which would cause the acid solution to attack the deposited copper and redissolve it. The operation is finished when bubbles of gas are coming from the platinum electrode and a drop of the solution, removed with a pipette, shows no discoloration with a drop of strong sulphuretted hydrogen water. Without disconnecting them, the tube *B* and the platinum electrode are lifted together from the beaker, and while the tube is returned to the beaker, the electrode is immersed in a beaker of water alongside. The electrical connection is now broken by detach-

ing the wire *W* and the electrode is further washed, first with water and then with alcohol, and finally dried in the usual way. It is now ready for weighing, to facilitate which a leaden counterpoise may be made, weighing a trifle less than the electrode, so that the difference may be quickly noted by the rider of the balance, and accordingly, in weighing the deposited copper it is simply necessary to deduct the amount previously determined by the rider. For further use the electrode is cleaned in nitric acid and fresh acid is placed in the tube *B*. Before setting aside, the tube *B* must be well rinsed with water inside and out to remove the acid from the diaphragm and prevent its rotting.

The above method cannot be used successfully on all ores. Much iron in solution increases the electrical resistance and hinders or entirely prevents the deposition of the copper. Other substances in solution may act similarly. Antimony, arsenic and bismuth (though the latter, of course, is of rare occurrence), if present in appreciable amount, are deposited with the copper. The method is particularly applicable with comparatively pure copper ores and products and the sulphide of copper obtained in analysis. The mode of decomposition may frequently be varied with advantage. For example, sulphide of copper may be warmed with a mixture of three cubic centimetres of sulphuric acid and a little water to which is added from time to time a few crystals of chlorate of potassium. Oxide of copper may be dissolved at once in dilute sulphuric acid. One gramme is the amount always to be taken for analysis.

While no simple way has yet been devised to remove antimony, arsenic may be sufficiently gotten rid of as follows: Evaporate the nitric acid solution in the flask nearly to dryness and add five cubic centimetres of strong hydrochloric acid. Boil till half the hydrochloric acid is gone and then add about two cubic centimetres of a solution of two grammes of sulphur in ten cubic centimetres of bromine. Again boil for half a minute and then add three cubic centimetres of sulphuric acid, and proceed as usual. As the acids and bromine go off so does the arsenic. What little may remain will not come down during the subsequent deposition of the copper.

The following examples are given to illustrate the accuracy of the method:

Sample of impure oxide of copper gave	Cu. per cent
By battery method	73.95
By new method	73.95
Another sample gave	
By battery method	73.99
By new method	73.98
A third sample gave	
By battery method	73.73
By new method	73.75
Three trials by the new method on another sample gave	{ 73.85 73.83 73.85
A sample of copper matte gave by new method	{ 46.90 46.89 46.90

Time, one and one-half hours in each case.

Many other examples might be given, but the above are considered sufficient.

The apparatus is manufactured by Messrs. Eimer & Amend, 205, 3d Avenue, New York City, N. Y.

Notes on a Sulpho-Bismuthite, BY E. LENEVE FOSTER.

Whilst in Mexico last summer my attention was directed to a mineral called by the Mexican miners *Pitanque*, and of which they designated two kinds; *Pitanque liso*, having a smooth appearance, and *Pitanque china*, having a crystalline appearance, which, however, is apparently due, not to a crystallization of the mineral, but to its cementing together small crystals of quartz. Upon careful examination I found this mineral to be a sulpho-bismuthite, very rich in silver; indeed, the principal silver mineral in the mine.

Upon more careful research since, I am led to the conclusion that it is a new variety of this class of mineral, of which several have been noticed of late years, and principally in the State of Colorado.

Of the already recognized minerals this one seems to most nearly resemble alaskaite, but it differs from that mineral in containing a much higher percentage of lead and silver, less bismuth, and no antimony. It occurs associated with quartz, iron pyrites and chalcopyrite, and has a whitish-gray color, with a strong metallic lustre. Its specific gravity

is 5.8 as obtained from four determinations, the highest being 5.96 and the lowest 5.62. Its hardness is 3 to 3.5, and it gives a black streak on porcelain.

B. B. in the open tube it gives fumes of sulphur dioxide. On charcoal an incrustation of lead oxide is obtained, and on continued blowing that for silver. With sulphur and iodide of potassium it gives the characteristic reaction for bismuth in a marked manner. By hydrochloric acid it is decomposed with precipitation of flocculent chloride of silver.

I am indebted to Mr. Geo. C. Tilden, of the State School of Mines, for the following analysis of this mineral.

Bismuth	34.51
Lead	21.51
Silver	13.47
Copper	2.32
Iron	0.87
Zinc	0.60
Silica	9.01
Sulphur	15.56
Moisture	0.76

98.61

After deducting admixed quartz 9 per cent. chalcopryrite 3 per cent., sphalerite 1 per cent. and 0.76 moisture, a more correct basis will undoubtedly be obtained for arriving at the true composition of this mineral, which will then be :

Bismuth	40.13
Lead	25.12
Silver	15.66
Copper	1.63
Sulphur	16.58

from which I deduce the formula $Pb_3Bi_5Ag_4S_{13}$, corresponding to $4Ag_2S, 6PbS, 5Bi_2S_3$, the silver being sometimes partially replaced by copper. The exact locality in which I found this mineral was in the Sierra Madre Mountains, at the Loreto mine, Candameña, State of Chihuahua, Mexico.

Mr. Hillebrand remarked that reduced to its simplest general formula, $2RS, BiS_3$, this mineral corresponded to cosalite, a variety of which was described by him at the December meeting.

Mr. vanDeist presented a preliminary report from the committee on Artesian Wells.

Mr. Pearce announced the discovery of several rare minerals among some copper-silver ores from the American Eagle mine, Tintic District, Utah Territory. Olivenite and conicalcrite seemed to be quite certainly identified by partial analysis.

MEETING OF MAY 5th, 1884.

Mr. vanDiest read a paper entitled "The proposed inland Sea of Africa," descriptive of the regions to be flooded and the means by which this result was to be effected.

Mr. Cross gave a summary of the theories advanced in explanation of the red sunsets seen during the preceding winter.

Mr. Hillebrand communicated analyses of the olivenite and conicalcrite presented by Mr. Pearce at the last meeting.*

Mr. Pearce announced that further examination of the material containing olivenite and conicalcrite had shown the presence of several other minerals, partial analyses upon which gave results approximating closely to those given for chenevixite and pitticite in Dana's Syst. of Min. A mineral in minute, white needle-like prisms, contained approximately 38.6 per cent. As_2O_5 and 31.5 per cent. CaO, besides copper oxide and water. The material was quite insufficient for accurate estimation of these constituents or for further determinations. From the same locality a brown mineral in small crystals had been identified as jarosite, by crystallographic measurements. With this latter was associated turgite.

Mr. Pearce also presented specimens of a green mineral associated with the hübnerrite of Phillipsburg, Montana Ter., which had been identified with the rare species pseudomalachite.

*For full details concerning these minerals and others mentioned by Mr. Pearce at this meeting, see paper read at the meeting of Dec., 1884, by W. F. Hillebrand, entitled "Mineralogical Notes."