not give all the information that is needed. I hope that later samples from other points on the Yukon may be available for analysis, in order that its possible variations may be discovered and recorded.

U. S. GEOLOGICAL SURVEY, WASHINGTON,
December 5, 1904.

THE WATER OF UTAH LAKE.[1]

By F. K. CAMERON.

Received November 29, 1904.

IN looking over the analyses of waters from several lakes and streams with Professor F. W. Clarke, the writer's attention was called to the great discrepancy between an unpublished analysis of water from Utah Lake made in the laboratory of the Bureau of Soils in 1903 and one made by Clarke twenty years earlier.[2] Further, neither of these analyses agree with one of a sample of water taken from the Jordan River at the outlet of the lake, made by the writer in 1899.[3] The results of these analyses are given below:

ANALYSES OF UTAH LAKE WATER.

Results stated in parts per million of solution.

	U. S. Geol. Survey.	Bureau of soils.	
	Clarke. 1883.	Cameron. 1899.	Brown. 1903.
Ca	55.8	67.6	80.0
Mg	18.6	13.8	92.0
Na	17.7	233.7	247.0
K	?	?	30.0
SO_4	130.6	236.7	365.0
Cl	12.4	316.5	336.0
HCO_3	......	......	266.0
CO_3	60.9	23.7	......
SiO_2	10.0	......	......
	306.0	892.0	1416.0

These figures show that the total salt content has increased very markedly since 1883, the greatest increase being in the sodium and the chlorine. In order to confirm this interesting observation, the Bureau has had a number of other samples collected at different points in the lake and analyzed. These samples were collected by

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[1] Published by permission of the Secretary of Agriculture.

[2] U. S. Geological Survey, Bull. No. 9, p. 99 (1884).

[3] Field Operations of the Division of Soils, 1899, p. 108.

Mr. W. H. Heileman on May 18, 1904. At this time the level of the lake was somewhat higher than usual, the surface being about two feet below "Compromise Point," and the water was slightly murky. The temperature of the lake water was about 65° F. One large sample of the lake water itself was taken, and two smaller ones from above springs in the bottom of the lake. The samples were as follows:

Sample No. 1 was taken from the center of Section 31, Range 1 East, Township 5 South. It was about one and a half miles from the North shore line, away from any inlet or other source of unfairness in sampling. It was taken 5 feet below the surface of the water, the depth at this point being 8 feet.

Samples Nos. 2 and 3 were taken above springs in the lake one and a quarter miles from where Sample No. 1 was taken. Their location is in Section 25, Range 1 West, Township 5 South. These two springs issue from the bed of the lake and the water over the crater of these springs is very deep. The cavities from which the springs pour into the lake are perhaps 200 feet in diameter. The water from the springs is warm, does not freeze in winter and much vapor or "steam" rises continually over the springs in cold weather. No. 2 was taken from the eastern spring at a depth of 12 feet, No. 3 from the western spring at a depth of 15 feet.

Sample No. 4 was collected on August 31, 1904, by Mr. Heileman. The level of the lake was still somewhat higher than is normal for the season of the year. This sample was taken off shore about one and a half miles from the town of Provo, Utah, at a depth of 3 feet, the lake itself being six feet in depth at this point. There were no inlets to the lake in the vicinity where the sample was taken.

The analyses of Samples Nos. 1, 2 and 3 were made by Dr. Atherton Seidell. A complete analysis of Sample No. 1 was made. Neither phosphates nor nitrates were recognized in repeated tests for them. In Samples No. 2 and 3 only the more important constituents present were determined and no attempt made to estimate rare alkalies or alkaline earths. Total solids by the evaporation of Sample No. 1 gave 1200 parts per million. Suspended matter in Sample No. 1 was 51 parts per million, and for samples Nos. 2 and 3, 53 parts per million. Sample No. 4 and the sample obtained in 1903 were analyzed by Mr. Bailey E. Brown, only the more important constituents being determined.

The analyses of these four samples of water from Utah Lake are given in the following table:

ANALYSES OF UTAH LAKE WATER.

Results stated in parts per million of solution.

	1.	2.	3.	4.
Ca	67.7	68.0	70.5	67.0
Sr	1.7	......	......	......
Mg	73.5	71.5	71.0	86.0
Na	207.2	218.3	210.5	230.0
K	25.8	24.3	25.7	22.0
Li	0.7	......	......	......
SO_4	332.9	330.4	324.4	378.0
Cl	288.5	288.5	288.5	337.0
HCO_3	205.5	266.0	260.0	194.0
CO_3	24.0	trace	trace	11.0
SiO_2	22.6	24.5	22.7	28.0
	1250.1	1291.5	1273.3	1353.0

It is at once apparent from the results that the analysis of 1903 is substantiated, and that the great discrepancies with the analysis of Clarke, in 1883, as well as with that of the writer, in 1899, are due to actual changes in the lake water itself. The greatest increase is in the sodium and the chlorine, and it is probably due to the sodium chloride in the seepage waters from the irrigated lands adjoining the lake. The probable causes of the increased total salt content of the lake water are: The influence of seepage water from the surrounding irrigated lands which have been brought under cultivation since the analysis of Clarke was made; the diversion of fresh streams for irrigation purposes, which streams formerly flowed directly into the lake; and the relatively large effects produced by evaporation in so shallow a body of water. An examination of the figures further shows that the composition of the waters taken from above the crater of the springs is not materially different in composition from that of the lake water taken elsewhere. Since the samples, however, were taken only at a moderate depth as compared with the depth of the craters it does not follow that the analyses represent the true composition of the spring waters themselves. Concerning these springs, Mr. Heileman writes:

"Recent surveys and explorations show that while there is little water entering the lake from streams, there is a great inflow continually from the springs issuing from the bed of the lake. The spring water is in part cold. There are also several hot springs issuing from the bed of the lake along its west shore line. One in particular has been explored which issues from a crater or sink 100 feet deep with a diameter of several hundred feet. The water delivered forms an important part of the present lake supply. A pipe lowered into the cavity caused the water to rise in the pipe above the lake surface. This water was too hot to permit coming in contact with the hands without seriously scalding or burning."

It is hoped that there will be an opportunity of securing the material necessary to make a comparison of the spring water with that of the lake.

BUREAU OF SOILS,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

[CONTRIBUTIONS FROM THE HAVEMEYER LABORATORIES OF COLUMBIA UNIVERSITY, NO. 102.]

THE APPLICATION OF BISMUTH AMMONIUM MOLYBDATE TO GRAVIMETRIC ANALYSIS.[1]

BY EDMUND H. MILLER AND FREDERICK VAN DYKE CRUSER.

Received December 9, 1904.

BISMUTH may be determined volumetrically by the titration of reduced molybdenum from bismuth ammonium molybdate, which is precipitated in a barely acid solution by ammonium molybdate.[2] It was suggested by Dr. W. A. Noyes that the precipitate of bismuth ammonium molybdate might be ignited and the combined oxides weighed.

Therefore, this work was undertaken in order to determine whether this method could be made sufficiently accurate to be used as a method for the determination of bismuth, and to determine how it compares with the volumetric method.

EXPERIMENTAL.

A bismuth nitrate solution was made up, containing about 19 grams of the crystallized salt per liter, and 45 grams of free nitric acid; also a large amount of ammonium sulphate solution and ammonium nitrate solution (each 30 grams of the crystallized salt per liter). The bismuth nitrate solution was first standard-

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[1] Read at the meeting of the New York Section of the American Chemical Society, January 6, 1905.

[2] Riederer: This Journal, **25**, 907 (1903).