DEPARTMENT OF THE INTERIOR
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GEORGE OTIS SMITH, DIRECTOR

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WATER ANALYSES

FROM THE

LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY

TABULATED BY

F. W. CLARKE, CHIEF CHEMIST

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WATER ANALYSES FROM THE LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY.

INTRODUCTION.

This paper contains 203 water analyses, which were made in the chemical laboratory of the United States Geological Survey. Most of these analyses have been published elsewhere, but many of the original documents are out of print, and are therefore obtainable with difficulty. Furthermore, the form of statement given the analyses has varied from time to time, so that the printed records show a lack of uniformity.

Many of the earlier analyses are less complete than those made more recently, but they nevertheless give a clear notion of the character of the waters analyzed. Some waters were analyzed by weight and others by volume, and of only relatively few were the specific gravities determined, so that one form of statement could be reduced to the other. With dilute waters milligrams per liter and parts per million are nearly identical; with concentrated waters or brines this equivalence no longer holds. The waters of the Yellowstone Park were all analyzed by weight—that is, weighed samples were taken for analysis, and regardless of concentration these results can be accurately stated in parts per million. For some other waters the statement in milligrams per liter is more nearly true. With waters of high concentration a larger unit of comparison is more convenient, and the statement is then made either in grams per liter or grams per kilogram. Every analysis, however, is given in two forms, one as stated above, the other in the percentage composition of the dissolved substances. In the latter mode of statement the variable of concentration is eliminated, and the true comparison of the waters is most readily made.

The old custom of reporting water analyses in terms of salts is now obsolete and therefore has no place here. Salts in solution are more or less completely dissociated into their ions, and only exceptionally can the form in which the ions might combine be accurately foretold. Two chemists reporting the same analysis in terms of salts might reach quite dissimilar conclusions, both in all probability being wrong. All the analyses given in this record are therefore stated in terms of

ions, or, more precisely, in terms of acid and basic radicles, and so represent the actual results of experiment with the minimum of hypothesis. To this rule one exception has been made. If waters contain free acids, hydrochloric, sulphuric, or boric, the acids are stated as such, for then, in spite of some uncertainty, the character of the solutions is best shown. To indicate the acidity in terms of free hydrogen ions would be much less clear, and perhaps no more nearly true. Silica as a rule is regarded as colloidal, and is so reported, but in some analyses it is partly or wholly represented by the acid radicle SiO_3. Here there is an unavoidable uncertainty, for the orthosilicic radicle, SiO_4, might be just as appropriately chosen. So also borates are represented by the group B_4O_7, although the orthoboric radicle, BO_3, is fully as legitimate. In every analysis the acid and basic, or negative and positive, radicles ought to balance; when one or the other is in excess either the analysis is in error or a correction in the statement of it should be made—that is, free acids are present on the one hand or silica should be recomputed into silicate terms on the other. To make a strictly logical and uniform statement of all the analyses is extremely difficult, if not at present impossible; but approximate uniformity is easily attained. To such a uniformity all the analyses here given have been reduced, and therefore some of them present a different appearance from that which they exhibited in previous publications.

Many of the waters represented in these pages are commonplace in character, but some are most unusual, if not unique. The Devil's Inkpot, in the Yellowstone Park, is essentially a solution of ammonium sulphate; the waters of Sulphur Bank are rich in borates; the Shoal Creek springs in Missouri contain a remarkable proportion of zinc.

The great number of water analyses made in the water-resources branch of the Survey are not considered here. They represent an independent field of investigation, and are fully published elsewhere.[1]

ANALYSES OF WATERS OF RIVERS, LAKES, WELLS, AND SPRINGS.

MAINE AND NEW YORK.

A. Water of W. E. Cooper's spring, near Mount Mica, Paris, Maine. In parts per million. Analysis by F. W. Clarke in 1886.

a. Percentage composition of saline matter in A.

B. Water of Caledonia Spring, Caledonia, New York. In parts per million. Analysis by H. N. Stokes in 1891.

b. Percentage composition of saline matter in B.

[1] See especially Water-Supply Papers 236, 237, 239, 273, 274, and 363.

	A	a	B	b
SO_4	369.6	57.41	292.6	28.17
CO_3	27.4	4.51	1.0	.09
HCO_3	48.8	7.32	219.6	21.14
Cl	Trace.	Trace.	206.1	19.85
K	1.2	.19	3.2	.31
Na	26.2	4.07	98.3	9.45
Ca	135.7	21.08	180.3	17.36
Mg	15.8	2.45	30.1	2.90
Fe''	2.1	.33	.....	.....
SiO_2	17.0	2.64	7.6	.73
	643.8	100.00	1,038.8	100.00

PENNSYLVANIA.

A. Water from Peoples Natural Gas Well, 8 miles southwest of Imperial, Washington County. Depth when sample was taken, 6,300 feet. Specific gravity, 1.211. Stated in grams per kilogram. This water is remarkable for its very high content of strontium. Analysis by George Steiger in 1913.

a. Percentage composition of dissolved salts.

	A	a
CO_3	None.	None.
SO_4	0.05	0.02
Cl	161.80	61.38
Br, I	.70	.26
Mg	2.48	.94
Ca	25.19	9.56
Sr	3.55	1.31
Ba	Trace.	Trace.
K	5.16	1.97
Na	64.55	24.50
Fe	.16	.06
	263.64	100.00

DISTRICT OF COLUMBIA.

Seven well waters, analyzed by Chase Palmer in 1910.

A. Well at Corby's bakery, 71 feet deep.

B. Well at Corby's bakery, 150 feet deep.

C. Well at corner of Sixth and B streets NW.

D. Well of Home Ice Co., Twelfth and V streets NW.

E. Well at Government Hospital for the Insane.

F. Well at Seventh and I streets SW.

G. Well of National Capital Brewing Co., O Street, between Thirteenth and Fourteenth streets SE.

All analyses stated in parts per million. Na and K not separated.

In Table II the same waters, lettered a, b, c, etc., are restated in percentages of dissolved matter.

I.—Parts per million.

	A	B	C	D	E	F	G
SO_4	7.9	10.0	26.0	7.4	18.0	2.7	15.0
HCO_3	8.4	23.0	125.0	24.0	80.0	28.0	8.5
Cl	9.8	5.4	76.0	18.0	120.0	5.9	86.0
NO_3	None.	None.	None.	.1	None.	None.	None.
Na, K	6.0	5.6	56.0	7.2	70.0	4.1	58.0
Ca	2.7	4.6	11.0	9.8	9.6	5.0	.6
Mg	1.4	2.0	18.0	3.0	12.0	3.3	.4
Al, Fe	2.3	2.8	1.8	.9	1.0	3.9	1.6
SiO_2	25.0	24.0	20.0	19.0	19.0	27.0	11.0
	63.5	77.4	333.8	89.4	329.6	79.9	181.1

II.—Percentage composition.

	a	b	c	d	e	f	g
SO_4	12.44	12.92	7.79	8.28	5.46	3.38	8.29
HCO_3	13.23	29.72	37.45	26.84	24.27	35.05	4.69
Cl	15.44	6.98	22.77	20.13	36.41	7.38	47.48
NO_3	None.	None.	None.	.11	None.	None.	None.
Na, K	9.45	7.24	16.78	8.06	21.24	5.13	32.03
Ca	4.25	5.94	3.29	10.96	2.91	6.26	.33
Mg	2.20	2.58	5.39	3.36	3.64	4.13	.22
Al, Fe	3.62	3.62	.54	1.01	.31	4.88	.88
SiO_2	39.37	31.00	5.99	21.25	5.76	33.79	6.08
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

VIRGINIA.

A. Well near Washington Brick Co.'s plant, Alexandria.

B. Well at St. Asaph and Washington streets, Alexandria.

C. Well of Belle Pré Bottling Co., Alexandria.

Analyses A, B, and C by Chase Palmer in 1910.

D, E. Water of two springs 1 mile from Farmwell station, Loudoun County. Analyses by R. B. Riggs in 1886.

All analyses stated in parts per million. In the second table, lettered a, b, c, etc., the percentage composition of the dissolved matter is given.

I.—Parts per million.

	A	B	C	D	E
SO_4	11.0	3.0	6.4	1,286.5	1,405.0
CO_3	None.	Trace.	None.	159.0	173.0
HCO_3	30.0	105.0	51.0	Undet.	Undet.
Cl	6.9	4.7	13.0	9.5	17.5
NO_3	None.	Trace.	1.0		
K	10.0	32.0	12.0	3.5	3.0
Na				80.5	92.0
Ca	4.1	8.6	6.5	523.5	561.0
Mg	2.6	19.0	3.9	15.0	19.5
Al, Fe	1.4	1.0	4.6		
Al_2O_3				7.0	10.5
SiO_2	33.0	27.0	38.0	21.0	11.0
	99.0	200.3	136.4	2,105.5	2,292.5

II.—Percentage composition.

	a	b	c	d	e
SO_4	11.11	1.50	4.70	61.10	61.29
CO_3	None.	Trace.	None.	7.55	7.55
HCO_3	30.30	52.42	37.39		
Cl	6.97	2.35	9.53	.45	.76
NO_3	None.	Trace.	.73		
K	10.10	15.97	8.80	.17	.13
Na				3.82	4.01
Ca	4.14	4.29	4.76	24.87	24.47
Mg	2.63	9.49	2.86	.71	.85
Al, Fe	1.41	.50	3.37		
Al_2O_3				.33	.46
SiO_2	33.34	13.48	27.86	1.00	.48
	100.00	100.00	100.00	100.00	100.00

Analyses F to K are of water from the Virginia Hot Springs. Analyzed in 1884 by F. W. Clarke. Stated in parts per million; CO_3 calculated to satisfy bases.

F. Boiler Bath, temperature 106° F.

G. Hot Spout Bath, temperature 105° F.

H. Octagon Bath, temperature 100° F.

I. New Hot Spring, temperature 99° F.

J. "Sulphur Bath," temperature 98.5° F.

K. Magnesian Spring, temperature 78.5° F.

In the second table, lettered f, g, etc., the percentage composition of the saline matter is given. In the water of the "Sulphur bath" neither sulphides nor H_2S was found.

I.—Parts per million.

	F	G	H	I	J	K
SO_4	131.9	129.8	136.4	129.4	127.3	72.1
CO_3	236.1	238.2	229.5	222.5	228.4	166.2
Cl	5.0	4.4	4.1	2.9	3.2	2.0
Br	Trace.	Trace.	.....	.....	.....	.....
K	11.7	13.2	12.8	12.7	10.7	7.1
Na	12.0	9.1	9.6	9.0	13.6	6.5
Ca	135.6	137.5	137.8	132.9	131.8	95.7
Mg	35.7	34.3	34.8	35.1	33.0	20.9
Al_2O_3	2.0	2.5	3.5	6.0	6.5	.....
SiO_2	27.5	23.5	25.5	23.5	23.0	12.0
	597.5	592.5	594.0	574.0	577.5	382.5

II.—Percentage composition.

	f	g	h	i	j	k
SO_4	22.07	21.91	22.96	22.54	22.04	18.85
CO_3	39.50	40.20	38.65	38.77	39.56	43.46
Cl	.83	.74	.69	.50	.55	.52
Br	Trace.	Trace.	.....	.....	.....	.....
K	1.95	2.23	2.15	2.21	1.85	1.85
Na	2.08	1.53	1.61	1.57	2.36	1.70
Ca	22.69	23.21	23.20	23.15	22.82	25.02
Mg	5.96	5.79	5.86	6.13	5.71	5.46
Al_2O_3	.32	.42	.59	1.04	1.13	.....
SiO_2	4.60	3.97	4.29	4.09	3.98	3.14
	100.00	100.00	100.00	100.00	100.00	100.00

WEST VIRGINIA.

A. Water from a deep well on Slaughters Creek near Coalburg. Specific gravity, 1.1595. Analysis by Chase Palmer, in 1914, stated in grams per kilogram of water.

a. Percentage composition of dissolved salts.

	A	a
CO_3	Trace.	Trace.
Cl	11.900	55.45
Br	.960	4.47
SO_4	None.	None.
HS [a]	.350	1.63
Mg	.380	1.77
Ca	2.220	10.35
Sr	.902	4.20
K	.430	2.00
Na	4.320	20.13
Ba, Mn	Traces.	Traces.
	21.462	100.00

[a] The acid radicle of the hydrosulphides.

NORTH CAROLINA, SOUTH CAROLINA, FLORIDA, AND MISSISSIPPI.

A. Water from spring on farm of W. E. Hall near Lowesville, North Carolina. Analysis by F. W. Clarke in 1888. CO_3 calculated to satisfy bases.

B. Well at foot of Charlotte Street, Charleston, South Carolina, 2,007 feet deep. Specific gravity, 1.0032.

C. Wentworth Street well, Charleston, 1,250 feet deep. Specific gravity, 1.0038.

Analyses B and C by Chase Palmer in 1912.

D. Surface drainage water, St. Augustine, Florida.

E. Water from 6-inch artesian well, St. Augustine.

F. Water from 12-inch artesian well, St. Augustine.

G. Water from well 4 miles northwest of Clinton, Hinds County, Mississippi.

Analyses D to G by T. M. Chatard in 1888. In E, F, and G small amounts of suspended matter were reported, but are omitted here. All analyses stated in parts per million. In Table II the percentage composition of the dissolved matter is given.

I.—Parts per million.

	A	B	C	D	E	F	G
SO_4	332.9	7.2	Trace.	52.4	325.3	342.1	985.2
CO_3	78.0	54.0	40.4	.....	3.0	.....	None.
HCO_3	Undet.	872.3	1,115.2	249.2	164.7	248.3	None.
Cl	2.9	92.4	943.9	107.6	546.9	1,475.0	72.4
K	2.2	4.4	41.3	9.8	14.7	24.8	8.8
Na	26.7	421.4	1,013.9	63.9	274.3	769.5	123.4
Ca	151.4	3.0	14.3	79.6	127.6	175.5	198.0
Sr	.....	.....	.....	.....	8.1	8.9	.....
Mg	9.4	.4	8.3	16.6	72.6	116.0	73.9
Mn	.....	.....	.....	.....	.....	.....	1.0
Al [a]	.....	.....	.....	.....	.....	.....	8.1
Al_2O_3	.....	.....	.....	1.5	.5	1.2	7.7
Fe_2O_3	.....	.....	.....		.....	.....	Trace.
Fe, Al	.....	1.0	Undet.	.....	.....	.....	.....
SiO_2	38.5	32.0	36.0	14.6	22.4	28.0	75.0
	642.0	1,488.1	3,213.3	592.2	1,560.1	3,189.3	1,552.5

II.—Percentage composition.

	a	b	c	d	e	f	g
SO_4	51.86	0.48	Trace.	8.81	20.84	10.73	63.42
CO_3	12.15	3.63	1.26	.....	.19	.....	None.
HCO_3	Undet.	58.62	34.71	41.86	10.56	7.79	None.
Cl	.45	6.21	29.38	18.07	35.05	46.25	4.66
K	.34	.29	1.28	1.65	.94	.78	.57
Na	4.16	28.32	31.56	10.74	17.59	24.13	7.94
Ca	23.58	.20	.44	13.37	8.18	5.49	12.75
Sr	.....	.....	.....	.....	.52	.28	.....
Mg	1.47	.03	.25	2.79	4.66	3.63	4.76
Mn	.....	.....	.....	.....	.....	.....	.06
Al	.....	.....	.....	.....	.....	.....	.52
Al_2O_3	.....	.....	.....	.25	.03	.04	.49
Fe_2O_3	.....	.....	.....		.....	.....	Trace.
Fe, Al	.....	.07	Undet.	.....	.....	.....	.....
SiO_2	5.99	2.15	1.12	2.46	1.44	.88	4.83
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[a] Probably combined as sulphate.

KENTUCKY AND TENNESSEE.

A. Water from the Murray well, 1 mile north of Frankfort, Kentucky. Specific gravity 0.99984 at 22° C.

B. Spring water, Mountain City, Tennessee.

C. Water of Grace Spring, 7 miles north of Mountain City, near Laurel Bloomery. Specific gravity, 1.00038 at 18.5° C.

Analyses by T. M. Chatard in 1888, stated in parts per million. Under a, b, and c the percentage of the dissolved salts is given.

	A	a	B	b	C	c
SO_4	187.3	12.07	13.2	12.81	699.7	60.89
HCO_3[a]	297.8	19.18	44.7	43.40	135.1	11.76
Cl	521.8	33.60	1.2	1.16	1.1	.09
K	20.7	1.34	3.2	3.11	4.6	.40
Na	460.4	29.65	4.6	4.47	4.7	.41
Ca	21.3	1.37	11.6	11.26	233.4	20.31
Sr[b]	12.2	.79	.....	.....	.....	.....
Mg	18.9	1.21	1.8	1.75	58.0	5.05
Li	Trace.	Trace.	.....	.....	.....	.....
Fe	1.4	.08	0.8	.78	.....	.....
Fe_2O_3	.....	.....	.....	.....	Trace.	Trace.
Al_2O_3	.....	.....	Trace.	Trace.	.....	.....
SiO_2	9.6	.62	21.9	21.26	12.5	1.09
NH_3	1.5	.09	.....	.....	.....	.....
	1,552.9	100.00	103.0	100.09	1,149.1	100.00

[a] In A 17.2 parts per million of free CO_2 was also determined.
[b] Determination uncertain. Figure probably too high.

ILLINOIS AND IOWA.

A. Water from spring at McLeansboro, Illinois. Analysis by R. B. Riggs in 1887.

B. Water from the "American Carlsbad Spring," Nashville, Illinois. Analysis by George Steiger in 1892.

C. Water from a deep well at Macomb, Illinois. Analysis by George Steiger in 1896.

D. Water from artesian well of Thorkill Henryson, Story City, Iowa.

E. Water from artesian well of Charles Watkins, Story City, Iowa.

Analyses D and E by F. W. Clarke in 1885, with carbonic acid determinations by Riggs.

All analyses stated in parts per million. In Table II the analyses are restated in percentages of total dissolved solids.

I.—Parts per million.

	A	B	C	D	E
SO_4	3,004.0	1,694.58	999.1	None.	None.
CO_3	112.8	1,142.12	395.3	219.1	273.8
HCO_3	597.8	Undet.	Undet.	Undet.	Undet.
Cl	34.5	24.44	541.8	1.0	Trace.
K	11.5	.....	23.7	.....	Trace.
Na	288.8	680.71	808.6	18.7	50.1
Ca	542.0	427.14	158.1	76.4	79.6
Mg	446.8	277.32	67.2	32.4	35.6
Al	.....	.....	.7	.....	.....
Al_2O_3	Trace.	3.60	.....	13.5	.....
Fe_2O_3	.....	.....	.....		6.0
Fe	.....	.....	1.3	.....	.....
SiO_2	14.2	12.40	10.5	Trace.	25.0
	5,052.4	4,262.31	3,006.3	361.1	470.1
Total CO_2	.....	.....	.....	268.0	392.0

II.—Percentage composition.

	a	b	c	d	e
SO_4	59.45	39.76	33.24	None.	None.
CO_3	2.23	26.80	13.15	60.66	58.24
HCO_3	11.84	Undet.	Undet.	Undet.	Undet.
Cl	.68	.57	18.03	.28	Trace.
K	.23	.....	.79	.....	Trace.
Na	5.72	15.97	26.90	5.18	10.66
Ca	10.73	10.02	5.24	21.16	16.94
Mg	8.84	6.51	2.24	8.98	7.57
Al	.....	.....	.02	.....	.....
Al_2O_3	Trace.	.08	.....	3.74	.....
Fe_2O_3	.....	.....	.....		1.27
Fe	.....	.....	.04	.....	.....
SiO_2	.28	.29	.35	Trace.	5.32
	100.00	100.00	100.00	100.00	100.00

MISSOURI.

A. Water from well 1,000 feet deep, at Lebanon, Laclede County. Analysis by L. G. Eakins in 1888.

B. Water from spring near Webster Grove, 10 miles west of St. Louis. Analysis by W. F. Hillebrand and E. L. Howard in 1889.

C. Water from Redell deep well, Joplin.

D. Water from spring on east margin of Shoal Creek Valley, $3\frac{1}{16}$ miles southeast of Thurman.

Analyses C and D by H. N. Stokes, 1902.

E and F. Water from two springs in Newton County, on road from Joplin to Seneca, near Shoal Creek. E, East spring. F, West spring. Notable for the large content of zinc. Analyses by W. F. Hillebrand[1] in 1891.

All analyses stated in parts per million. In Table II the analyses, lettered a, b, c, etc., are restated in percentage composition of dissolved solids.

I.—Parts per million.

	A	B	C	D	E	F
SO_4	4.8	18.5	25.4	4.2	284.9	287.6
CO_3	103.0	142.5	.....	.....	13.7	15.7
HCO_3	Undet.	Undet.	173.6	142.3	.....	.....
Cl	Trace.	11.0	9.3	1.7	2.6	2.6
NO_3	.....	17.6	.....	.....	.....	.....
K	.....	1.1	5.6	1.0	2.5	2.5
Na	12.6	15.0	9.6	2.4	3.6	3.9
Li	.....	.....	Trace.	None.	.....	.....
Ca	32.5	97.0	40.3	42.6	61.1	63.1
Mg	16.2	12.7	12.8	2.5	3.8	4.2
Al	.....	.....	Trace.	Trace.	.4	.5
Al_2O_3	3.2	2.6	.....	.....	.....	.....
Fe_2O_3	.....					
Fe	Trace.	.....	.4	Trace.	.6	.6
Mn	.....	.....	.....	.....	2.3	2.4
Cu	.....	.....	Trace.	Trace.	.2	Undet.
Zn	.....	.....	None.	None.	120.5	132.4
Cd	.....	.....	.....	.....	.5	Undet.
Pb	.....	.....	.....	.....	Trace.	Undet.
SiO_2	11.2	26.4	47.7	15.0	44.4	56.1
	183.5	344.4	324.7	211.7	541.1	571.6
Free CO_2	70.0	5.0	None.	1.3	.....	.....

[1] For a detailed account of these waters see Hillebrand, W. F., in U. S. Geol. Survey Bull. 113, p. 49, 1893.

II.—Percentage composition.

	a	b	c	d	e	f
SO_4	2.62	5.37	7.82	1.98	52.64	50.32
CO_3	56.13	41.37	.....	.....	2.53	2.75
HCO_3	Undet.	Undet.	53.46	67.22	.....	.....
Cl	Trace.	3.19	2.86	.80	.48	.46
NO_3	.....	5.11	.....	.....	.....	.....
K	.....	.32	1.72	.47	.46	.44
Na	6.86	4.35	2.95	1.13	.67	.68
Li	.....	.....	Trace.	None.	.....	.....
Ca	17.72	28.16	12.41	20.13	11.29	11.04
Mg	8.83	3.69	3.94	1.18	.72	.73
Al	.....	.....	Trace.	Trace.	.07	.09
Al_2O_3	1.74	.75	.....	.....	.....	.....
Fe_2O_3	.....	.....	.....	.....	.....	.....
Fe	Trace.	.....	.12	Trace.	.11	.10
Mn	.....	.....	.....	.....	.42	.42
Cu	.....	.....	Trace.	Trace.	.04	Undet.
Zn	.....	.....	None.	None.	22.27	23.16
Cd	.....	.....	.....	.....	.09	Undet.
Pb	.....	.....	.....	.....	Trace.	Undet.
SiO_2	6.10	7.69	14.72	7.09	8.21	9.81
	100.00	100.00	100.00	100.00	100.00	100.00

ARKANSAS.

A. Water of Happy Hollow Spring, Hot Springs. Analysis by R. B. Riggs in 1887.

B. Water of "Potash Sulphur Springs," Garland County, 8 miles southeast of Hot Springs. Partial analysis by F. W. Clarke in 1887 on an insufficient quantity of water. CO_3 calculated to satisfy bases. No H_2S in the water as received.

C, D. Water from two springs at Hominy Hill. C. Old or upper spring. D. New or lower spring. Analyses by J. E. Whitfield in 1887.

E. Water from Mountain Valley Spring, near Magnet Cove. Analysis by H. N. Stokes in 1897.

All analyses stated in parts per million. In Table II the analyses, lettered a, b, c, etc., are restated in percentage of total dissolved salts.

I.—Parts per million.

	A	B	C	D	E
SO_4	.....	202.7	4.1	8.5	7.6
CO_3	.....	145.8	.....	.....	.....
HCO_3	8.1	.....	112.8	63.5	243.6
Cl	3.0	40.5	Trace.	Trace.	3.1
K	3.1	22.7	4.0	1.2	1.4
Na		221.6	6.0	3.6	2.4
Li	.....	.....	Trace.	Trace.	Trace.
Ca	1.7	3.2	26.0	16.8	69.2
Sr	.....	.....	.....	.....	Trace.
Mg	.....	None.	3.4	2.4	7.7
Al	.....	.....	Trace.	None.	.....
Fe	.....	.....	Trace.	Trace.	.....
Al_2O_3	.8	2.0	.....	.....	.....
Fe_2O_3					
PO_4	.....	.....	.....	.....	Trace.
SiO_2	5.2	27.5	12.2	10.0	12.4
	21.9	666.0	168.5	106.0	347.4
Free CO_2	22.0	.....	.....	.....	13.2

II.—Percentage composition.

	a	b	c	d	e
SO_4		30.43	2.43	8.02	2.19
CO_3		21.89			
HCO_3	36.99		66.94	59.91	70.13
Cl	13.70	6.08	Trace.	Trace.	.89
K	} 14.15	3.41	2.38	1.14	.40
Na		33.28	3.56	3.39	.69
Li			Trace.	Trace.	Trace.
Ca	7.76	.48	15.43	15.85	19.91
Sr					Trace.
Mg		None.	2.02	2.26	2.22
Al			Trace.	None.	
Fe			Trace.	Trace.	
$(Al, Fe)_2O_3$	3.65	.30			
PO_4					Trace.
SiO_2	23.75	4.13	7.24	9.43	3.57
	100.00	100.00	100.00	100.00	100.00

OKLAHOMA.

A and B. Two waters from Sulphur, analyzed by E. T. Allen in 1901.

A. Bromide spring, in parts per million.

B. Pavilion spring, in parts per million.

Under a and b the percentage composition of the dissolved salts is given.

Analysis A is somewhat doubtful, because it was made on two samples of water collected at different times.

	A	a	B	b
SO_4	42.1	0.97	32.4	2.78
CO_3	277.0	6.44	121.2	10.39
HCO_3	158.0	3.68	83.8	7.18
Cl	1,986.0	46.18	482.0	41.22
Br	12.4	.29	1.4	.12
K	6.0	.14	24.2	2.08
Na	1,700.0	39.55	269.0	23.06
Li	Trace.	Trace.	Trace.	Trace.
Ca	60.8	1.41	86.2	7.39
Mg	20.0	.47	35.0	3.00
Fe_2O_3, etc	8.0	.19	8.0	.69
SiO_2	29.6	.69	24.4	2.09
	4,299.9	100.00	1,167.6	100.00

TEXAS.

A. Brine from Humble oil field, near Houston. Analysis by Chase Palmer in 1910.

B. Brine from Grand Saline.

C. Bittern from Grand Saline brine. Analyses B and C by R. K. Bailey in 1913.

All three analyses are stated in grams per kilogram. Under a, b, and c the analyses are restated in percentages of total solids.

	A	a	B	b	C	c
SO_4	3.51	3.89	3.4	1.28	2.5	0.95
Cl	53.07	58.80	157.1	59.44	158.3	59.96
Na	} 31.38	} 34.77	102.1	38.71	101.3	38.37
K			.1	.04	.4	.15
Ca	2.00	2.22	1.5	.53	1.5	.57
Mg	.29	.32				
	90.25	100.00	264.2	100.00	264.0	100.00

WYOMING.

A. Brine from 3 miles southeast of Cambria. Analysis by George Steiger in 1899. Stated in grams per liter.

B. Water of Lake De Smet.

C. Water of Shell Creek, a feeder of Lake De Smet.

Analyses B and C by W. T. Schaller in 1909. Stated in milligrams per liter, or parts per million nearly.

Under a, b, and c the percentage composition of the saline matter in each water is given.

	A	a	B	b	C	c
SO_4	4.279	7.42	4,129	61.55	.467	43.94
CO_3	.....	.....	67	1.00	22	2.08
HCO_3	.....	.....	536	7.99	273	25.68
Cl	31.479	54.55	58	.87	8	.75
K	None.	None.	82	1.22	5	.47
Na	20.280	35.14	1,342	20.00	83	7.80
Ca	1.400	2.43	71	1.05	109	10.26
Mg	.267	.46	406	6.06	77	7.24
$(Al, Fe)_2O_3$	.....	.....	3	.05	4	.37
SiO_2	.....	.....	14	.21	15	1.41
	57.705	100.00	6,708	100.00	1,063	100.00

THE YELLOWSTONE NATIONAL PARK.

The waters of the Yellowstone National Park were analyzed by F. A. Gooch and J. E. Whitfield in the years 1884 to 1889. All but three of the analyses, made by Whitfield in 1889, were originally published in Bulletin 47, in which the methods of analysis are fully described. The results, however, were stated in a form somewhat different from that now in use, and the figures are therefore recalculated here into modern shape. In the original report the data are given in grams per kilogram; here they are stated in parts per million, a change in the position of the decimal point only.

The portion of CO_2 reported as uncombined is here wholly or partially recalculated into the bicarbonate radicle HCO_3, according to the requirements in each individual case. The effect of this change is in most cases to raise the summation of the analysis by a small amount. Any excess of CO_2, however, is separately stated and not included in the summation. The analyses, therefore, now present a somewhat different appearance from the original statements, although the essential data are unchanged.

The first group in the following tabulation is devoted to the lake and river waters of the region.

A. The Yellowstone Lake. Water collected in 1884. Specific gravity, 1.00014.

B. Gardiner River, above Mammoth Hot Springs.

C. Gardiner River, between Mammoth Hot Springs and Gardiner.

D. Firehole River, near Marshalls. Specific gravity, 1.00015.

E. Firehole River, Upper Basin. Specific gravity, 1.000155.

F. Alum Creek. Specific gravity, 1.001055. Contains free HCl. Analyses by Whitfield in 1886, with special determinations by Gooch. Stated in parts per million.

In Table II the percentage composition of the dissolved solids is given.

I.—Parts per million.

	A	B	C	D	E	F
SO_4	8.4	14.0	96.2	10.1	7.4	504.2
CO_3	.....	19.1	.....	17.2	.....	.....
HCO_3	49.5	79.0	239.1	126.7	41.6	.....
Cl	9.4	4.9	30.1	73.7	10.5	38.6
HCl	.....	.....	.....	.....	.....	168.8
Br	.....	.....	.....	.....	.....	Trace.
K	4.7	7.9	10.5	17.0	9.4	74.1
Na	15.6	20.0	31.1	93.0	15.1	159.5
Li	Trace.	Trace.	Trace.	1.1	Trace.	.9
Ca	8.6	25.0	74.9	6.6	5.2	12.7
Mg	.3	.5	17.5	.7	1.1	3.8
Al	2.1	4.2	1.0	3.1	2.9	2.5
Fe	None.			Trace.	Trace.	25.0
B_4O_7	None.	.....	.....	6.7	Trace.	6.3
AsO_2	None.	.....	.....	None.	None.	None.
SiO_2	42.0	46.9	27.2	96.5	40.7	218.0
NH_4	.42	Undet.	Undet.	Undet.	.02	1.06
	141.02	221.5	527.6	452.4	133.92	1,215.46
Free CO_2	36.8	.....	.....	.....	.....	7.5

II.—Percentage composition.

	a	b	c	d	e	f
SO_4	5.95	6.32	18.24	2.24	5.53	41.48
CO_3	.....	8.62	.....	3.81	.....	.....
HCO_3	35.11	35.67	45.32	28.01	31.07	.....
Cl	6.67	2.21	5.70	16.29	7.84	3.17
HCl	.....	.....	.....	.....	.....	13.89
Br	.....	.....	.....	.....	.....	Trace.
K	3.33	3.57	1.99	3.76	7.02	6.09
Na	11.06	9.03	5.89	20.55	11.28	13.12
Li	Trace.	Trace.	Trace.	.24	Trace.	.07
Ca	6.10	11.29	14.20	1.46	3.88	1.05
Mg	.21	.23	3.32	.15	.82	.31
Al	1.48	1.89	.19	.68	2.16	.21
Fe	None.			Trace.	Trace.	2.06
B_4O_7	None.	.....	.....	1.48	Trace.	.52
AsO_2	None.	.....	.....	None.	None.	None.
SiO_2	29.79	21.17	5.15	21.33	30.39	17.94
NH_4	.30	Undet.	Undet.	Undet.	.01	.09
	100.00	100.00	100.00	100.00	100.00	100.00

The second group of analyses is of waters collected at Mammoth Hot Springs.

A. Water supply of hotel at Mammoth Hot Springs, 1884. Analysis by Gooch.

B. Water of Hot River. Specific gravity, 1.001541. Analysis by Whitfield.

C. Orange Geyser. Analysis by Gooch.

D. Cleopatra Spring. Specific gravity, 1.002055. Analysis by Whitfield.

E. Soda Spring. Specific gravity, 1.00041. Analysis by Whitfield.

Analyses stated in parts per million. Restated in Table II, under a, b, c, etc., in percentages of dissolved substances.

I.—Parts per million.

	A	B	C	D	E
SO_4	37.2	507.6	528.8	527.4	46.8
CO_3	.....	.....	208.9	.....	.....
HCO_3	133.6	589.6	256.1	769.4	249.6
Cl	2.2	160.4	162.3	174.9	4.4
Br	.....	None.	Trace.	Trace.	None.
K	3.1	46.2	61.0	51.1	2.7
Na	14.5	150.6	123.3	129.9	3.9
Li	None.	1.1	1.6	2.3	None.
Ca	31.6	236.0	282.1	307.6	80.8
Mg	8.9	63.1	65.9	72.9	10.6
Fe	1.1		1.2	4.9	5.3
Al		5.1			.4
B_4O_7	.....	14.2	Present.	25.2	None.
AsO_2	.....	.5	.....	3.4	None.
SiO_2	35.5	50.0	50.2	51.7	18.4
NH_4	.....	.11	.....	.63	.5
	267.7	1,824.51	1,741.4	2,121.33	423.4
Free CO_2	26.6	.....	.....	73.7	493.5

II.—Percentage composition.

	a	b	c	d	e
SO_4	13.89	27.82	30.37	24.86	11.05
CO_3	.....	.....	11.99	.....	.....
HCO_3	49.92	32.32	14.71	36.27	58.95
Cl	.83	8.79	9.32	8.25	1.04
Br	.....	None.	Trace.	Trace.	None.
K	1.16	2.53	3.50	2.41	.64
Na	5.41	8.25	7.08	6.12	.92
Li	None.	.06	.09	.10	None.
Ca	11.81	12.93	16.20	14.50	19.08
Mg	3.32	3.46	3.78	3.44	2.51
Fe	.41	.....	.07	.23	1.25
Al		.28			.09
B_4O_7	.....	.78	.....	1.19	None.
AsO_2	.....	.03	.....	.16	None.
SiO_2	13.25	2.74	2.89	2.44	4.35
NH_4	.....	.01	.....	.03	.12
	100.00	100.00	100.00	100.00	100.00

The following waters were collected in the Norris Basin. Analyses by Whitfield with some special determinations by Gooch.

A. Fearless Geyser. Specific gravity, 1.0011, at 15.5° C. This water contains traces of cæsium and rubidium.

B. Pearl Geyser. Specific gravity, 1.0011 at 15.5° C. B_4O_7 was computed to satisfy excess of soda, actual determination having been prevented by loss of material.

C. Constant Geyser. Specific gravity, 1.001152.

D. Coral Spring. Sample taken in 1884. Specific gravity, 1.0013.

E. Coral Spring. Sample taken in 1886. Specific gravity, 1.00124.

F. Echinus Spring. Specific gravity, 1.000711.

G. Schlammkessel. Specific gravity, 1.001304.

H. Opal Spring. Specific gravity, 1.00145. Not reported in Bulletin 47. Analysis made in 1889.

All analyses stated in parts per million, with percentage composition of the dissolved substances in Table II. Free hydrochloric acid is given as such, not in the form of ions. Cl represents the chlorine of metallic chlorides.

I.—Parts per million.

	A	B	C	D	E	F	G	H
SO_4	44.0	27.4	110.8	31.7	33.6	231.5	121.4	27.3
CO_3	.....	10.2	None.	None.	None.	None.	None.	None.
HCO_3	6.4	.....	None.	None.	2.9	None.	None.	None.
Cl	670.5	652.0	546.1	694.6	670.1	94.0	570.6	462.8
HCl	.....	.....	28.7	14.4	.....	27.4	70.4	252.1
Br	2.6	Undet.	Trace.	.....	.....	Trace.	Trace.	.....
K	41.5	54.4	74.5	72.9	81.5	39.5	25.4	109.0
Na	404.6	404.6	319.0	393.6	392.5	126.5	365.4	223.0
Li	8.1	2.2	3.0	2.0	4.0	Trace.	2.9	4.5
Ca	9.2	6.4	14.6	10.2	7.1	11.5	7.8	3.3
Mg	.1	.9	1.8	2.2	1.4	None.	.3	.3
Al	.2	3.1	4.8	2.9	7.7	2.7	8.1	2.6
Fe	.6	Trace.	Trace.	Trace.	Trace.	None.		.....
Mn	None.	Trace.	.....	.....	.....	.....	.....	.....
B_4O_7	24.8	[30.4]	35.3	36.5	41.0	19.2	43.5	None.
AsO_2	2.4	4.1	2.0	.8	1.0	1.9	None.	None.
SiO_2	418.0	463.6	468.5	607.0	580.5	253.2	457.7	762.0
NH_4	.25	.21	1.27	.43	.3	1.06	6.33	None.
H_2S	Trace.	Trace.	None.	None.	None.	Trace.	Trace.	.....
	1,633.25	1,659.51	1,610.37	1,869.23	1,823.6	808.46	1,679.83	1,846.9
Free CO_2	.....	.....	15.5	42.5	24.1	25.0	17.5	.....

II.—Percentage composition.

	a	b	c	d	e	f	g	h
SO_4	2.69	1.65	6.88	1.70	1.85	28.63	7.23	1.47
CO_3	.....	.62	None.	None.	None.	None.	None.	None.
HCO_3	.39	.....	None.	None.	.16	None.	None.	None.
Cl	41.05	39.28	33.91	37.16	36.75	11.63	33.96	25.06
HCl	.....	.....	1.78	.77	.....	3.39	4.19	13.65
Br	.16	Undet.	Trace.	.....	.....	Trace.	Trace.	.....
K	2.54	3.28	4.68	3.90	4.47	4.88	1.51	5.91
Na	24.77	24.39	19.80	21.06	21.53	15.65	21.75	12.07
Li	.49	.13	.18	.11	.22	Trace.	.17	.24
Ca	.56	.38	.90	.54	.35	1.43	.47	.18
Mg	.01	.06	.11	.12	.08	None.	.02	.02
Al	.02	.18	.29	.15	.43	.33	.48	.14
Fe	.06	Trace.	Trace.	Trace.	Trace.	None.		.....
Mn	None.	Trace.	.....	.....	.....	.....	.....	.....
B_4O_7	1.52	1.83	2.19	1.96	2.25	2.38	2.59	None.
AsO_2	.14	.25	.11	.04	.05	.23	None.	None.
SiO_2	25.58	27.94	29.09	32.47	31.84	31.32	27.25	41.26
NH_4	.02	.01	.08	.02	.02	.38	.13	None.
H_2S	Trace.	Trace.	None.	None.	None.	Trace.	Trace.	.....
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Waters of the Lower and Midway Geyser basins:

A. Fountain Geyser, Lower Basin. Specific gravity, 1.0010, at 15.5° C. Analysis by Gooch.

B. Great Fountain Geyser, Lower Basin. Specific gravity, 1.00104. Analysis by Whitfield.

C. Hygeia Spring, Lower Basin. Specific gravity, 1.001075. Analysis by Whitfield.

D. Madison Spring, Terrace Springs, near junction of Firehole and Gibbon rivers. Specific gravity, 1.001001. Analysis by Whitfield.

E. Excelsior Geyser, Midway Basin. Specific gravity, 1.0011, 15.5° C. Analysis by Gooch.

All analyses stated in parts per million. Percentage composition of dissolved substances given in Table II.

I.—Parts per million.

	A	B	C	D	E
SO_4	23.4	22.2	23.5	14.8	17.5
CO_3	None.	None.	None.	None.	149.3
HCO_3	222.1	270.8	306.1	779.7	378.4
Cl	333.7	350.8	248.7	69.8	279.3
Br	.4	Undet.	Trace.	None.	Trace.
K	37.9	14.5	15.4	38.5	32.5
Na	352.2	335.1	265.4	293.0	418.6
Li	3.5	2.5	3.2	.4	2.0
Ca	1.4	1.7	6.4	25.5	2.2
Mg	1.0	2.3	2.2	1.7	2.2
Al	5.7	2.1	3.6	None.	1.2
Fe	.2	Trace.	None.	None.	1.8
Mn	Trace.	.....	.....	.....	Trace.
B_4O_7	15.4	11.1	26.5	14.5	18.0
AsO_2	2.9	1.8	3.6	Trace.	2.8
PO_4	.05	.....	.....	.....	Trace.
SiO_2	331.5	318.2	247.7	150.7	221.4
NH_4	.15	Undet.	.21	.8	.01
H_2S	Trace.	None.	.....	None.	Trace.
	1,331.5	1,333.1	1,152.51	1,389.4	1,527.21
Free CO_2	70.5	12.1	69.9	51.6	.....

II.—Percentage composition.

	a	b	c	d	e
SO_4	1.76	1.67	2.04	1.07	1.15
CO_3	None.	None.	None.	None.	9.78
HCO_3	16.68	20.32	26.56	56.11	24.78
Cl	25.07	26.31	21.58	5.03	18.29
Br	.03	Undet.	Trace.	None.	Trace.
K	2.85	1.08	1.33	2.77	2.13
Na	26.45	25.14	23.03	21.09	27.41
Li	.26	.19	.28	.03	.13
Ca	.11	.13	.56	1.83	.14
Mg	.07	.17	.19	.13	14
Al	42	.16	.31	None.	.08
Fe	.01	Trace.	Trace.	None.	.12
Mn	Trace.				Trace.
B_4O_7	1.16	.83	2.30	1.04	1.18
AsO_2	.22	.13	.31	Trace.	.18
PO_4	Trace.				Trace.
SiO_2	24.90	23.87	21.49	10.84	14.49
NH_4	.01	Undet.	.02	.06	Trace.
H_2S	Trace.	None.			Trace.
	100.00	100.00	100.00	100.00	100.00

Waters of the Upper Geyser Basin:

A. Giantess Geyser. Specific gravity, 1.0010, at 15.5° C. Analysis by Gooch.

B. Splendid Geyser. Sample taken in 1884. Specific gravity, 1.00127. Analysis by Whitfield.

C. Splendid Geyser. Sample taken in 1885. Specific gravity, 1.00151. Analysis by Gooch and Whitfield.

D. Grotto Geyser. Specific gravity, 1.001205. Analysis by Whitfield.

E. Old Faithful Geyser. Specific gravity, 1.00096, at 15.5° C. Analysis by Gooch. This water contains traces of cæsium and rubidium.

All analyses stated in parts per million. Percentage composition of the dissolved substances is given in Table II.

I.—Parts per million.

	A	B	C	D	E
SO_4	20.2	19.0	19.0	17.7	18.2
CO_3	85.8	29.8	38.2	104.4	121.9
HCO_3	59.1	530.1	551.5	331.3	None.
Cl	440.8	318.1	322.7	304.5	439.1
Br	Trace.	None.	None.	Trace.	3.4
K	41.0	15.2	14.1	24.9	26.7
Na	345.1	417.9	440.7	385.3	366.6
Li	5.7	3.7	2.3	4.1	5.6
Ca	.7	3.4	3.0	3.9	1.5
Mg	1.2	1.5	.5	1.0	.6
Al	4.9	3.4	2.7	3.6	.9
Fe	Trace.	Trace.	.08	Trace.	Trace.
Mn			None.		Trace.
B_4O_7	24.9	26.7	26.1	32.3	16.5
AsO_2	.7	1.1	2.1	.4	2.3
PO_4			.16		None.
SiO_3					17.3
SiO_2	391.7	300.0	296.4	259.0	369.1
NH_4	Undet.	.42	.08	.23	.01
H_2S	Trace.	None.	None.		.2
	1,412.2	1,670.32	1,717.62	1,472.63	1,389.91

II.—Percentage composition.

	a	b	c	d	e
SO_4	1.42	1.14	1.10	1.20	1.31
CO_3	6.02	1.78	2.22	7.09	8.77
HCO_3	4.04	31.74	32.12	22.49	None.
Cl	31.02	19.05	18.78	20.68	31.58
Br	Trace.	None.	None.	Trace.	.25
K	2.88	.91	.70	1.69	1.94
Na	24.28	25.02	25.71	26.16	26.37
Li	.40	.22	.13	.28	.40
Ca	.05	.20	.17	.26	.11
Mg	.08	.09	.02	.07	.04
Al	.35	.20	.15	.25	.06
Fe	Trace.	Trace.	.005	Trace.	Trace.
Mn	.....	.....	None.	.....	Trace.
B_4O_7	1.75	1.59	1.51	2.19	1.19
AsO_2	.05	.07	.12	.03	.17
PO_4	.....	.....	.01	.....	None.
SiO_2	.....	.....	.....	.....	1.24
SiO_2	27.56	17.96	17.25	17.59	26.56
NH_4	Undet.	.03	.005	.02	Trace.
H_2S	Trace.	None.	None.	.....	.01
	100.00	100.00	100.00	100.00	100.00

Waters of the Upper Geyser Basin—Continued. Analyses by Whitfield, with special determinations by Gooch:

A. Beehive Geyser. Specific gravity, 1.000955.

B. Artemisia Geyser. Specific gravity, 1.001215.

C. Turban and Grand Geysers. Specific gravity, 1.001085. The vents of these geysers are connected.

D. Bench Spring.[1]

E. Asta Spring.

All analyses stated in parts per million. The percentage composition of the dissolved solids is given in Table II.

I.—Parts per million.

	A	B	C	D	E
SO_4	32.5	15.2	26.2	138.1	38.9
CO_3	102.0	104.3	105.8	Undet.	None.
HCO_3	23.8	384.9	162.8	Undet.	209.3
Cl	389.4	299.6	376.7	Trace.	94.7
Br	Trace.	Trace.	Trace.	.....	None.
K	21.3	16.3	16.7	9.7	11.6
Na	311.8	398.8	381.8	57.4	134.0
Li	6.1	7.0	3.6	Trace.	.8
Ca	3.9	1.4	2.8	Trace.	11.8
Mg	.2	None.	None.	Trace.	1.0
Al	2.9	7.9	3.2	14.5	5.9
Fe	Trace.	Trace.	Trace.		
B_4O_7	16.1	19.7	27.1	None.	Trace.
AsO_2	1.2	1.5	1.2	None.	None.
SiO_2	304.2	273.7	303.5	240.0	165.0
NH_4	.21	.21	.42	.....	.....
H_2S	None.	None.	Trace.	None.	None.
	1,215.61	1,530.51	1,411.82	459.7	673.0
Free CO_2	.....	.....	.....	.....	29.0

[1] Analysis made on an insufficient quantity of water. As given, there is an excess of basic over acid radicles. Part of the Al is to be reckoned as sulphate, part as Al_2O_3.

II.—Percentage composition.

	a	b	c	d	e
SO_4	2.67	0.99	1.75	30.04	5.78
CO_3	8.30	6.82	7.50	Undet.	None.
HCO_3	1.96	25.15	11.54	Undet.	31.10
Cl	32.13	19.57	26.70	Trace.	14.08
Br	Trace.	Trace.	Trace.	.....	None.
K	1.75	1.06	1.19	2.11	1.72
Na	25.64	26.06	27.06	12.49	19.91
Li	.50	.46	.25	Trace.	.12
Ca	.32	.09	.20	Trace.	1.75
Mg	.02	None.	None.	Trace.	.15
Al	.24	.52	.25	3.15	.87
Fe	Trace.	Trace.	Trace.		
B_4O_7	1.32	1.29	1.93	None.	Trace.
AsO_2	.10	.10	.08	None.	None.
SiO_2	25.03	17.88	21.52	52.21	24.52
NH_4	.02	.01	.03	.....	.....
H_2S	None.	None.	Trace.	None.	None.
	100.00	100.00	100.00	100.00	100.00

The following group of analyses of waters from scattered localities in the Yellowstone National Park was made by Whitfield, with boric acid determinations by Gooch:

A. Taurus Geyser, Shoshone Basin. Specific gravity, 1.00105.

B. Chromé Spring, Crater Hill. Specific gravity, 1.002315.

C. Spring at Soda Butte. Specific gravity, 1.001383.

D. Mushpots Spring, Pelican Creek. Specific gravity, 1.000885.

E. Cache Creek Spring or "Marble Bath." Partial analysis, the water having undergone change since it was collected. Analysis made in 1889 and not reported in Bulletin 47.

F. Green Spring, near Twin Lakes. Specific gravity, 1.00112. Strongly acid. Analysis made in 1889 and not reported in Bulletin 47.

G. The Devil's Inkpot, Mount Washburn. Specific gravity, 1.002214. A unique water rich in ammonium sulphate and strongly acid. In this and some other waters the free acids are stated as HCl and H_2SO_4. In certain analyses B_2O_3 is restated as orthoboric acid, H_3BO_3.

All analyses stated in parts per million. The percentage composition of the dissolved substances is given in Table II.

I.—Parts per million.

	A	B	C	D	E	F	G
SO_4	46.2	434.3	73.7	557.4	5.5	348.0	2,276.9
CO_3	None.	None.	None.	None.	None.	None.	None.
HCO_3	None.	None.	1,080.4	None.	1,646.5	None.	None.
Cl	193.5	1,020.7	31.5	.....	67.0	Trace.	.....
Br	None.	Undet.	None.	.....	.....	.....	.....
K	23.5	160.3	23.8	19.5	45.2	25.1	8.3
Na	320.2	732.0	57.5	117.5	130.0	24.0	7.2
Li	.9	6.4	Trace.	None.	.....	None.	.4
Ca	Trace.	14.0	232.5	63.2	230.8	32.0	39.6
Mg	.9	2.0	63.2	21.4	123.8	2.2	12.1
Al	4.0	4.3	6.9	4.5	2.2	34.6	3.7
Fe	Trace.			Trace.	.....	.....	Trace.
B_4O_7	16.5	39.8	16.7	.....	Present.	None.	.....
AsO_2	.8	7.7	None.	None.	None.	None.	None.
SiO_3	309.8	.....	.....	.....	.....	.....	.....
SiO_2	48.0	375.0	33.5	227.0	65.1	260.0	89.7
NH_4	1.0	10.6	5.7	10.0	13.2	None.	768.7
HCl	.....	.....	.....	4.8	.....	.....	6.0
H_2SO_4	.....	.....	.....	89.8	.....	539.8	36.3
H_3BO_3	.....	85.9	.....	9.9	.....	.....	98.9
H_2S	None.	None.	4.2	None.	104.0	.....	5.1
	965.3	2,893.0	1,629.6	1,125.0	2,433.3	1,265.7	3,352.9
Free CO_2	321.0	14.7	471.4	4.5	208.3	.....	64.7

II.—Percentage composition.

	a	b	c	d	e	f	g
SO_4	4.79	15.01	4.53	49.55	0.23	27.49	67.91
CO_3	None.	None.	None.	None.	None.	None.	None.
HCO_3	None.	None.	66.31	None.	67.67	None.	None.
Cl	20.05	35.28	1.93	.....	2.76	Trace.	.....
Br	None.	Undet.	None.	.....	.....	.....	.....
K	2.43	5.54	1.46	1.73	1.86	1.90	.25
Na	33.17	25.34	3.53	10.45	5.34	1.97	.22
Li	.09	.22	Trace.	None.	.....	None.	.01
Ca	Trace.	.48	14.27	5.62	9.48	2.53	1.18
Mg	.09	.07	3.86	1.90	5.09	.18	.36
Al	.42	.15	.42	.40	.09	2.74	.11
Fe	Trace.			Trace.	.....	.....	Trace.
B_4O_7	1.71	1.37	1.02	.....	.....	None.	.....
AsO_2	.07	.26	None.	None.	None.	None.	None.
SiO_3	32.10	.....	.....	.....	.....	.....	.....
SiO_2	4.98	12.95	2.06	20.17	2.67	20.54	2.68
NH_4	.10	.36	.35	.89	.54	None.	22.92
HCl	.....	.....	.....	.43	.....	.....	.17
H_2SO_4	.....	.....	.....	7.98	.....	42.65	1.09
H_3BO_3	.....	2.97	.....	.88	.....	.....	2.95
H_2S	None.	None.	.26	None.	4.27	.....	.15
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

MONTANA.

A. Livingston Warm Springs. Free H_2S present.

B. Helena Hot Springs, Helena. Temperature 60.5° C.

C. Warm Springs of Emigrant Gulch, Yellowstone Valley.

D. Mill Creek Cold Spring, Yellowstone Valley.

Analyses A to D by F. W. Clarke in 1884. CO_3 calculated to satisfy bases.

E. Matthews Warm Springs, 7 miles from Bozeman. Temperature 44.5 ° C.

F. Spring No. 2, White Sulphur Springs, Meagher County. Temperature 45.5° C. Traces of H_2S present.

Analyses E and F by R. B. Riggs in 1885.

All analyses stated in parts per million. The percentage composition of the dissolved matter is given under a, b, c, etc., in Table II.

I.—Parts per million.

	A	B	C	D	E	F
SO_4	222.4	185.4	32.9	650.0	135.5	302.5
CO_3	248.4	114.0	86.8	1,316.6	71.9	424.0
Cl	12.4	36.2	7.4	277.1	50.5	187.5
I	.....	.....	.....	Trace.	.....	.....
K	4.1	.....	4.3	51.3	7.0	42.5
Na	25.6	187.3	29.9	881.4	164.0	490.0
Li	.....	.....	.....	.....	.....	Trace.
Ca	167.8	10.7	34.6	376.8	13.6	51.2
Mg	43.8	Trace.	7.7	81.1	1.0	12.5
$(Al, Fe)_2O_3$	.....	.....	.....	87.5	.....	.....
SiO_3	.....	.....	.....	.....	63.7	11.1
SiO_2	29.0	93.8	31.7	25.0	86.4	33.0
	753.5	627.4	235.3	3,746.8	591.6	1,554.3

II.—Percentage composition.

	a	b	c	d	e	f
SO_4	29.52	29.51	13.98	17.35	22.57	19.47
CO_3	32.97	18.17	36.88	35.14	12.15	27.28
Cl	1.64	5.77	3.14	7.39	8.54	12.08
I				Trace.		
K	.54		1.83	1.37	1.18	2.73
Na	3.39	29.89	12.71	23.53	27.73	31.53
Li						Trace.
Ca	22.28	1.71	14.71	10.06	2.30	3.29
Mg	5.81	Trace.	3.28	2.17	.17	.79
$(Al, Fe)_2O_3$				2.34		
SiO_3					10.76	.71
SiO_2	3.85	14.95	13.47	.65	14.60	2.12
	100.00	100.00	100.00	100.00	100.00	100.00

COLORADO.

A. Spring near Denver. Specific gravity 1.063 at 20.8° C. Analysis by L. G. Eakins in 1888. Originally stated in grams per kilogram.

B. Cold Sulphur Spring, Idaho Springs.

C. Blue Ribbon Spring, Idaho Springs.

D. Hot Spring, Idaho Springs.

Analyses B, C, and D by W. T. Schaller, 1906.

E. Fariss artesian well, Pueblo. Analysis by H. N. Stokes, 1894.

F. Artesian well, Rocky Ford. Specific gravity 1.0008 at 30.5° C. Analysis by W. F. Hillebrand, 1895.

All analyses stated in parts per million. The percentage composition of the dissolved solids is given in Table II.

I.—Parts per million.

	A	B	C	D	E	F
SO_4	41,361.7	317.7	352.1	391.6	514.0	453.80
HCO_3		985.3	1,320.4	1,302.7	321.7	194.93
Cl	1,492.2	45.7	58.3	61.4	24.7	28.20
Br					None.	Trace?
I					Trace.	Trace.
NO_3					None.	.39
K	127.1	54.6	59.0	66.1	15.4	7.00
Na	6,397.6	343.5	457.3	447.8	245.3	259.20
Li	Trace.	Trace.	Trace.	Trace.	Trace.	.46
Ca	302.4	109.8	128.5	145.1	57.9	14.95
Mg	7,286.9	29.2	35.1	36.0	32.5	12.40
Sr		Trace.	Trace.	Trace.	1.3	.50
Mn					Trace.	Trace.
Fe						2.80
Fe_2O_3	Trace.	3.0	7.6	3.7	1.0	
Al_2O_3		1.4	Trace?	.9		Trace?
PO_4					None.	Trace.
B_4O_7		Undet.	7.8	11.8	Trace.	None.
Cu		Trace.	None.	None.		
Zn		Trace?	None.	None.		
SiO_2	28.0	56.5	65.0	69.4	10.1	11.90
NH_4	Trace.				Trace.	.80
	56,995.9	1,946.7	2,491.1	2,536.5	1,223.9	987.33
Free CO_2	210.1	28.3	18.3	461.0	31.2	39.3

II.—Percentage composition.

	a	b	c	d	e	f
SO_4	72.57	16.33	14.17	15.44	41.99	45.96
HCO_3	.....	50.62	53.00	51.36	26.29	19.75
Cl	2.62	2.34	2.35	2.42	2.02	2.86
Br	.....	.....	.....	.....	None.	Trace?
I	.....	.....	.....	.....	Trace.	Trace.
NO_3	.....	.....	.....	.....	None.	.04
K	.22	2.80	2.36	2.60	1.26	.71
Na	11.22	17.65	18.35	17.65	20.04	26.25
Li	Trace.	Trace.	Trace.	Trace.	Trace.	.05
Ca	.54	5.64	5.16	5.72	4.73	1.50
Mg	12.78	1.50	1.40	1.42	2.66	1.26
Sr	.....	Trace.	Trace.	Trace.	.11	.05
Mn	.....	.....	.....	.....	Trace.	Trace.
Fe	.....	.....	.....	.....	.....	.28
Fe_2O_3	Trace.	.15	.30	.14	.08	.....
Al_2O_3	Trace.	.07	Trace.	.04	.....	Trace?
PO_4	.....	.....	.....	.....	None.	Trace.
B_4O_7	.....	Undet.	.31	.47	Trace.	None.
Cu	.....	Trace.	None.	None.	.....	.....
Zn	.....	Trace?	None.	None.	.....	.....
SiO_2	.05	2.90	2.60	2.74	.82	1.21
NH_4	Trace.	.....	.....	.....	Trace.	.08
	100.00	100.00	100.00	100.00	100.00	100.00

G. Artesian water from well 420 feet deep.

H. Artesian water from well 386 feet deep. Both wells at Atchison, Topeka & Santa Fe Railroad shops.

I, J. Surface wells.

Waters G to J are all from La Junta. Analyses by W. F. Hillebrand in 1895.

K. Spring near bed of West Dolores River, at Dunton. Analysis by H. N. Stokes, 1899.

L, M. Two waters from the Slumgullion mud flow, San Cristobal quadrangle. Analyses by George Steiger, 1908.

All analyses stated in parts per million. The percentage composition of the dissolved substances is given in Table II.

I.—Parts per million.

	G	H	I	J	K	L	M
SO_4	675.9	71.1	552.5	550.6	308.00	3,088.4	3,273.5
CO_3	.....	34.1	37.1	.....	.....	.....	.....
HCO_3	339.2	1,583.0	138.3	127.8	1,113.29	.....	.....
Cl	54.0	66.9	55.9	56.1	14.24	.....	.....
K	6.4	6.4	6.2	6.2	17.21	1.5	5.6
Na	360.0	668.7	142.9	143.2	38.80	19.5	19.3
Li	Trace.	Trace.	Trace.	Trace.	Trace.	.....	.....
Ca	73.8	4.4	145.4	140.4	371.22	409.5	477.5
Mg	20.7	2.5	34.2	35.8	48.75	.8	1.9
Sr	.....	.....	.....	.....	2.64	Trace.	None.
Mn	.1	Trace.	.....	.....	1.80	12.5	20.4
Fe	.8	2.4	.....	.....	4.46	232.7	46.0
Al	Trace?	3.4	.....	.....	.43	224.9	277.7
B_4O_7	.....	.....	.....	.....	Trace.	.....	.....
PO_4	Trace.	.....	.....	.....	.17	.....	.....
SiO_2	16.1	51.0	17.8	15.4	40.10	113.9	118.2
Cu	.....	.....	.....	.....	Trace.	.....	.....
	1,547.0	2,459.8	1,127.3	1,112.6	1,961.11	4,104.0	4,240.1
Free CO_2	.....	.....	.....	.....	65.80	.....	.....

II.—Percentage composition.

	g	h	i	j	k	l	m
SO_4	43.69	2.89	49.02	49.49	15.72	75.25	77.19
CO_3	.....	.....	3.02	3.34	.....	.....	.....
HCO_3	21.93	64.35	12.27	11.49	56.78	.....	.....
Cl	3.49	2.72	4.96	5.04	.72	.....	.....
K	.41	.26	.55	.55	.88	.03	.13
Na	23.27	27.18	12.68	12.87	1.98	.47	.48
Li	Trace.	Trace.	Trace.	Trace.	Trace.	.....	.....
Ca	4.77	.18	12.89	12.62	18.93	10.00	11.26
Mg	1.34	.10	3.03	3.22	2.48	.02	.05
Sr	.....	.....	.....	.....	.13	Trace.	None.
Mn	.01	Trace.	.....	.....	.09	.31	.48
Fe	.05	.10	.....	.....	.22	5.67	1.08
Al	Trace?	.14	.....	.....	.02	5.48	6.55
B_4O_7	.....	.....	.....	.....	Trace.	.....	.....
PO_4	Trace.	.....	.....	.....	.01	.....	.....
SiO_2	1.04	2.08	1.58	1.38	2.04	2.77	2.78
Cu	.....	.....	.....	.....	Trace.	.....	.....
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Three hot springs, Wagon Wheel Gap, about 8 miles southeast of Creede.

N. Main Spring.

O. McClelland Spring.

P. Soda Spring.

Specific gravity 1.001 for each water. Analyses by George Steiger in 1914. All analyses stated in parts per million. Under n, o, and p the percentage composition of the dissolved solids is given.

	N	n	O	o	P	p
Cl	202.5	10.82	200.0	9.70	195.5	9.96
SO_4	178.6	9.54	171.8	8.33	132.0	6.73
CO_3	.....	.....	.....	.....	69.6	3.55
HCO_3	865.0	46.21	1,015.0	49.24	915.0	46.63
Mg	17.7	.95	16.9	.82	16.3	.83
Ca	19.8	1.06	67.1	3.25	70.0	3.56
Sr	1.7	.09	2.7	.13	2.5	.13
K	41.2	2.20	50.4	2.45	34.8	1.77
Na	456.4	24.38	444.8	21.58	446.6	22.76
Li	1.2	.06	2.4	.12	1.8	.09
Al,Fe	.8	.04	1.4	.07	1.9	.10
SiO_2	87.0	4.65	88.9	4.31	76.4	3.89
	1,871.9	100.00	2,061.4	100.00	1,962.4	100.00
Free CO_2	38.3	.....	31.7	.....	.....	.....

UTAH.

A. Water of Bear River, a tributary of Great Salt Lake. Sample actually taken at Evanston, Wyoming, but more appropriately classed here.

B. Water of City Creek, above Salt Lake City reservoir.

C. Utah Lake.[1]

D. Utah Hot Springs, 8 miles north of Ogden.

Analyses A to D by F. W. Clarke in 1884. CO_3 calculated to satisfy bases.

E. Beck's Hot Springs, north of Salt Lake City. Analysis by R. B. Riggs in 1886.

All analyses stated in milligrams per liter, or parts per million, nearly. The percentage composition of the dissolved substances is given in Table II, under a, b, c, etc.

[1] Recent analyses, 1899 to 1904, of the water of Utah Lake have been made in the Bureau of Soils, U. S. Department of Agriculture. They show a complete change in the character of the water, due to irrigation. Chlorides have largely increased and concentration is quadrupled. For the detailed analyses see The Data of Geochemistry: Bull. U. S. Geol. Survey 491, p. 145, 1911.

I.—Milligrams per liter.

	A	B	C	D	E
SO_4	10.5	7.0	130.6	218.4	840.5
CO_3	96.8	128.0	59.8	144.0	75.7
HCO_3					130.9
Cl	4.9	13.1	12.4	13,703.0	6,743.8
Br				Trace.	
K	8.2	9.1	17.8	875.9	196.9
Na				7,082.5	3,754.9
Li					Trace.
Ca	43.2	58.9	55.8	1,142.8	694.3
Mg	12.5	17.4	18.6	92.9	109.5
B_4O_7					Trace.
Al_2O_3		1.0		4.0	9.0
SiO_2	7.0	9.0	10.0	46.0	31.5
	183.1	243.5	305.0	23,309.5	12,587.0

II.—Percentage composition.

	a	b	c	d	e
SO_4	5.73	2.87	42.82	0.93	6.68
CO_3	52.87	52.57	19.61	.62	.60
HCO_3					1.04
Cl	2.68	5.38	4.06	58.77	53.58
Br				Trace.	
K	4.48	3.74	5.83	3.75	1.57
Na				30.38	29.84
Li					Trace.
Ca	23.59	24.19	18.30	4.94	5.52
Mg	6.83	7.15	6.10	.39	.85
B_4O_7					Trace.
Al_2O_3		.41		.02	.07
SiO_2	3.82	3.69	3.28	.20	.25
	100.00	100.00	100.00	100.00	100.00

F. Water from Jackson Bros.' Spring, Nephi.

G. Bittern from Inland Crystal Salt Co., Salt Lake City.

Analyses by R. K. Bailey in 1913, stated in grams per kilogram. Under f and g the percentage composition of the saline matter is given.

	F	f	G	g
Cl	156.80	59.71	146.8	51.95
SO_4	3.20	1.22	34.0	12.03
Mg			13.8	4.90
Ca	.13	.05		
Na	102.10	38.89	79.5	28.15
K	.35	.13	8.4	2.97
	262.58	100.00	282.5	100.00

NEW MEXICO.

A. Spring 1 mile west of Santa Fe. Analysis by F. W. Clarke in 1885. CO_3 calculated to satisfy bases.

B. Spring near Fort Wingate. Analysis by Clarke in 1886, with CO_3 determination by R. B. Riggs.

C. Thermal spring at Ojo Caliente, near Taos. Specific gravity 1.00273, at 18.4° C. Alkaline. Analysis by W. F. Hillebrand, 1892. Bromine, manganese, and sulphides absent.

All analyses stated in parts per million. Under a, b, and c the percentage composition of the dissolved substances is given.

	A	a	B	b	C	c
SO_4	18.7	6.59	282.2	39.79	151.0	4.07
CO_3	135.5	47.80	53.3	7.52	47.5	1.28
HCO_3			162.0	22.84	2,150.0	57.87
Cl	11.7	4.13	6.6	.93	231.4	6.23
I					Trace?	Trace?
NO_3					Trace.	Trace.
K	Undet.	Undet.	2.4	.35	31.4	.84
Na	14.9	5.25	15.6	2.20	995.1	26.78
Li					3.44	.10
Ca	63.4	22.37	135.0	19.03	22.8	.62
Sr					1.4	.03
Ba					Trace.	Trace.
Mg	17.3	6.10	36.1	5.09	9.5	.26
B_4O_7					4.2	.11
AsO_4					Trace.	Trace.
PO_4					.2	Trace.
Fe_2O_3					1.6	.04
Al_2O_3					.5	.01
SiO_2	22.0	7.76	16.0	2.25	60.2	1.62
NH_4					Trace.	Trace.
F					5.2	.14
	283.5	100.00	709.2	100.00	3,715.44	100.00

NEVADA.

A. Steamboat Springs. Analysis by W. H. Melville, published by G. F. Becker in U. S. Geol. Survey Mon. 13, p. 349, 1888. Contains traces of cæsium, rubidium, and mercury. These springs deposit a sinter containing gold, silver, and the sulphides of mercury, lead, copper, arsenic, and antimony.

B. Hot spring. Hot Spring station, Central Pacific Railroad (abandoned line). Analysis by T. M. Chatard in 1884.

C. Hot Spring, Ward's ranch, foot of Granite Mountain. Analysis by Chatard, 1884.

D. Water of Walker River, just below junction of branches.

E. Water of Walker Lake, at surface.

F. Water of Walker Lake, at 215 feet depth. Analyses D, E, and F, by F. W. Clarke, 1884, with CO_3 calculated to satisfy bases.

All analyses stated in milligrams per liter, or parts per million, nearly. The percentage composition of the dissolved substances is given under a, b, c, etc., in Table II.

I.—Milligrams per liter.

	A	B	C	D	E	F
SO_4	124.77	355.5	313.1	28.4	527.5	512.5
CO_3	34.73		578.7	56.4	429.7	422.4
HCO_3	210.76					
Cl	952.56	967.9	227.2	13.1	587.5	580.0
PO_4	.84					
B_4O_7	242.22					
S	5.88					
K	103.31	66.9	63.0	} 31.8	Trace.	Trace.
Na	825.72	774.3	611.6		857.7	853.0
Li	7.09	Trace.	Trace.	Trace.		
Ca	6.84	30.5	58.9	22.8	26.7	17.6
Mg	.29	1.0	60.4	3.8	39.1	37.5
Fe	.14					
Al_2O_3	.25		1.8			
Al		1.0				
SiO_3	98.37	92.2	154.5			
SiO_2	232.99	206.0		22.5	7.5	7.5
As	2.75					
Sb	.43					
	2,849.94	2,495.3	2,069.2	178.8	2,475.7	2,430.5

II.—Percentage composition.

	a	b	c	d	e	
SO_4	4.38	14.25	15.13	15.88	21.30	21.09
CO_3	1.22	.....	27.97	31.54	17.36	17.35
HCO_3	7.39	.....	.....	.....	.....	.....
Cl	33.43	38.79	10.98	7.33	23.72	23.87
PO_4	.03	.....	.....	.....	.....	.....
B_4O_7	8.50	.....	.....	.....	.....	.....
S	.21	.....	.....	.....	.....	.....
K	3.63	2.69	3.05	}	Trace.	Trace.
Na	28.97	31.04	29.56	} 17.78	34.64	35.11
Li	.25	Trace.	Trace.	Trace.	.....	.....
Ca	.24	1.23	2.84	12.78	1.08	.72
Mg	.01	.04	2.92	2.12	1.58	1.55
Fe	Trace.	.....	.....	.....	.....	.....
Al_2O_3	.01	.....	.09	.....	.....	.....
Al	.....	.04	.....	.....	.....	.....
SiO_3	3.45	3.67	7.46	12.57	.32	.31
SiO_2	8.17	8.25	.....	.....	.....	.....
As	.09	.....	.....	.....	.....	.....
Sb	.02	.....	.....	.....	.....	.....
	100.00	100.00	100.00	100.00	100.00	100.00

G. Water of Humboldt River, taken at Stone House.

H. Water of Winnemucca Lake. Specific gravity, 1.001 at 17° C.

I. Pyramid Lake, "salt" end, 1 foot below surface.

J. Pyramid Lake, "salt" end, 350 feet below surface.

K. Pyramid Lake, "fresh" end, 1 foot below surface.

L. Pyramid Lake, "fresh" end, 200 feet below surface.

Analyses G to L by F. W. Clarke in 1884. CO_3 calculated to satisfy bases.

M. Water of Timberlake Well, Fallon. Analysis by W. B. Hicks in 1913. All analyses in this group are stated in milligrams per liter, with the percentage composition of the dissolved solids in Table II.

I.—Milligrams per liter.

	G	H	I	J	K	L	M
SO_4	47.7	133.3	180.3	185.0	177.2	186.4	92.0
CO_3	137.5	280.6	495.6	487.1	467.6	481.6	85.0
HCO_3	.....	.....	.....	.....	.....	.....	449.0
Cl	7.5	1,693.4	1,429.8	1,434.2	1,428.8	1,427.1	623.0
K	10.0	68.6	76.6	72.3	71.9	72.6	11.0
Na	46.7	1,297.0	1,173.1	1,181.7	1,182.6	1,180.9	697.0
Ca	48.9	19.6	17.9	17.9	.....	.....	2.0
Mg	12.4	17.3	80.0	80.5	75.2	83.2	.5
Al_2O_3	1.3	.....	.....	.....	.....	.....	.....
SiO_2	32.6	27.5	41.2	20.0	42.5	30.0	35.0
	344.6	3,537.3	3,494.5	3,478.7	3,445.8	3,461.8	1,994.5

II.—Percentage composition.

	g	h	i	j	k	l	m
SO_4	13.84	3.77	5.16	5.31	5.15	5.38	4.61
CO_3	39.90	7.93	14.18	14.00	13.57	13.92	4.26
HCO_3	.....	.....	.....	.....	.....	.....	22.51
Cl	2.18	47.88	40.92	41.23	41.47	41.22	31.24
K	2.90	1.94	2.19	2.08	2.07	2.09	.55
Na	13.55	36.66	33.57	33.97	34.32	34.11	34.96
Ca	14.19	.56	.51	.51	.....	.....	.10
Mg	3.60	.49	2.29	2.32	2.18	2.41	.02
Al_2O_3	.38	.....	.....	.....	.....	.....	.....
SiO_2	9.46	.77	1.18	.58	1.24	.87	1.75
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

N. Large soda lake near Ragtown. Sample taken 1 foot below surface. Specific gravity, 1.101.

O. Large soda lake near Ragtown. Sample taken 100 feet below surface. Specific gravity, 1.101.

Analyses by T. M. Chatard in 1884. Stated in grams per liter. CO_3 calculated to satisfy bases. The percentage composition of the dissolved salts is given under n and o in the same table.

	N	n	O	o
SO_4	12.960	10.36	13.150	10.52
CO_3	14.052	11.23	9.750	7.80
HCO_3	3.182	2.55	9.967	7.97
Cl	45.690	36.51	44.270	35.42
B_4O_7	.314	.25	.327	.27
K	2.520	2.01	2.670	2.14
Na	45.840	36.63	44.270	35.42
Mg	.270	.22	.270	.21
SiO_2	.304	.24	.310	.25
	125.132	100.00	124.984	100.00

CALIFORNIA.

A. Water of Lake Tahoe. Analysis by F. W. Clarke in 1884. CO_3 calculated to satisfy bases.

B. Boiling Spring, 4 miles southeast of Shaffer's ranch, Honey Lake valley. Analysis by T. M. Chatard, 1884.

C. Warm Spring, Warm Spring station, Mono basin. Analysis by Chatard, 1884. CO_3 calculated to satisfy bases.

D. Spring on Tufa Crag, Mono Lake. Analysis by Chatard, 1884. CO_3 calculated to satisfy bases.

E. Matilija Hot Springs, near San Buenaventura. Analysis by R. B. Riggs, 1887.

All stated in milligrams per liter. In Table II the percentage composition of the dissolved substances is given.

I.—Milligrams per liter.

	A	B	C	D	E
SO_4	5.4	349.2	313.1	54.6	16.9
CO_3	28.0	Trace.	577.5	100.8	57.9
Cl	2.3	207.0	227.2	14.4	876.8
K	3.3	9.4	63.0	8.8	32.5
Na	7.3	304.0	611.6	51.3	545.6
Ca	9.3	12.1	58.9	41.4	65.0
Mg	3.0	.4	60.4	4.4	3.4
Al_2O_3	.....	.....	1.8	.....	.....
SiO_3	.....	38.2	154.5	.....	41.2
SiO_2	13.7	100.8	.....	17.8	8.8
	72.3	1,021.1	2,068.0	293.5	1,648.1

II.—Percentage composition.

	a	b	c	d	e
SO_4	7.47	34.20	15.14	18.60	1.04
CO_3	38.72	Trace.	27.92	34.35	3.52
Cl	3.18	20.27	10.98	4.91	53.21
K	4.56	.92	3.05	2.99	1.97
Na	10.10	29.77	29.58	17.48	33.10
Ca	12.87	1.18	2.85	14.11	3.92
Mg	4.15	.04	2.92	1.50	.20
Al_2O_3	.....	.....	.09	.....	.....
SiO_3	.....	3.75	7.47	.....	2.50
SiO_2	18.95	9.87	.....	6.06	.54
	100.00	100.00	100.00	100.00	100.00

F. Borax Lake. Analysis by W. H. Melville, published by G. F. Becker in U. S. Geol. Survey Mon. 13, p. 265, 1888.

G. Mono Lake. Specific gravity, 1.0456 at 17.5° C. Analysis by T. M. Chatard, 1886.

H. Owens Lake. Specific gravity, 1.06246 at 15.5° C. Analysis by Chatard, 1887.

I, J, K. Water from three pits on the east shore of Owens Lake. Analyses by Chatard, 1887. In his paper on natural soda (U. S. Geol. Survey Bull. 60, pp. 27–101, 1890) Chatard gives analyses of various products of fractional crystallization from the water of Owens Lake.

L. Owens Lake. Analysis by W. B. Hicks in 1913. Shows increased concentration since 1887. Specific gravity, 1.0977. The analysis is recalculated to uniformity of statement with Chatard's analysis. Originally stated in parts per thousand.

All analyses stated in grams per liter. In Table II the percentage composition of the dissolved solids is given.

I.—Grams per liter.

	F	G	H	I	J	K	L
SO_4	0.0987	6.6720	7.5009	7.308	10.396	5.924	11.99
CO_3	16.5210	10.5690	19.0882	16.368	21.572	15.784	24.09
HCO_3	1.3906	3.1730	.3717	4.392	7.320	10.736	5.26
Cl	24.7091	12.1036	19.3527	24.316	29.412	23.808	31.60
Br	.0263		None.				
B_4O_7	3.8644	.1600	.3590	Present.	Undet.	Undet.	2.31
PO_4	.0138						
K	1.1703	.9614	1.6447	2.352	2.612	2.020	2.53
Na	29.1669	19.6853	28.5146	32.064	41.896	33.427	45.87
Ca	.0240	.0200	.0148	Undet.	.020	.014	
Mg	.2674	.0551	.0053	Undet.	.009	Undet.	
Mn	.0009						
Fe_2O_3	.0039	.0030	.0138				
Al_2O_3	.0029		.0244	Undet.	.008	.008	
SiO_3			.2783				
SiO_2	.0109	.0700		.296	.316	.260	.25
S				Trace.	.120	.161	
Organic	3.6184						
	80.8895	53.4724	77.1684	87.096	113.681	92.142	123.90

II.—Percentage composition.

	f	g	h	i	j	k	l
SO_4	0.12	12.47	9.72	8.38	9.14	6.43	9.74
CO_3	20.42	19.76	24.73	18.80	18.98	17.13	19.58
HCO_3	1.72	5.93	.48	5.04	6.44	11.65	4.29
Cl	30.55	22.64	25.08	27.92	25.88	25.84	25.00
Br	.03		None.				
B_4O_7	4.78	.30	.47	Present.	Undet.	Undet.	1.88
PO_4	.02						
K	1.47	1.80	2.13	2.70	2.30	2.19	2.06
Na	36.06	36.82	36.95	36.82	36.85	36.28	37.25
Ca	.03	.04	.02	Undet.	.02	.02	
Mg	.33	.10	.01	Undet.	.01	Undet.	
Mn	Trace.						
Fe_2O_3	Trace.	.01	.02				
Al_2O_3	Trace.		.03	Undet.	.01	.01	
SiO_3							
SiO_2	.01	.13	.36	.34	.27	.28	.20
S					.10	.17	
Organic	4.46						
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Four brines from survey wells about 15 miles a little south of east from Furnace Creek ranch, Death Valley.

M. Well No. 200, at 32 feet depth.

N. Same, at 38 feet.

O. Same, at 70 feet.

P. Well No. 300, at 1 foot.

Two brines from "Soda Lake," sink of Mojave River, about 30 miles north of Ludlow, Inyo County.

Q. Specific gravity, 1.25.

R. Specific gravity, 1.26

Analysis by R. K. Bailey in 1913, stated in grams per kilogram. The percentage composition of the dissolved solids is given in Table II.

I.—Grams per kilogram.

	M	N	O	P	Q	R
Cl	151.2	140.20	142.10	154.40	124.60	118.00
SO_4	22.6	44.50	37.60	14.00	52.00	59.20
CO_3					9.83	6.90
HCO_3					2.40	1.90
B_4O_7	1.2	1.32	3.00	1.03	2.10	1.90
Ca	.2					
Mg	.15	.15	.25	.14		
Na	105.9	109.32	107.90	103.00	114.20	115.30
K	3.7	4.01	5.80	4.51	.007	.008
	284.95	299.50	296.65	277.08	305.137	303.208

II.—Percentage composition.

	m	n	o	p	q	r
Cl	53.07	46.81	47.92	55.74	40.84	38.90
SO_4	7.93	14.81	12.67	5.05	17.05	19.50
CO_3					3.22	2.25
HCO_3					.78	.74
B_4O_7	.42	.44	1.01	.37	.68	.63
Ca	.07					
Mg	.05	.05	.08	.04		
Na	37.17	36.54	36.38	37.18	37.43	37.98
K	1.29	1.35	1.95	1.62	Trace.	Trace.
	100.00	100.00	100.00	100.00	100.00	100.00

S. Bittern, Long Branch Salt Co., Long Branch.

T. Bittern, Mount Eden, Alameda County.

U. Bittern, Alvarado, Alameda County.

V. Bittern, Leslie, San Mateo County.

Analyses by R. K. Bailey in 1913, stated in grams per kilogram.

I.—Grams per kilogram.

	S	T	U	V
Cl	148.5	152.0	152.6	150.4
SO_4	34.1	60.5	26.2	44.3
Na	61.0	25.2	70.7	45.0
K	.7	11.6	5.0	9.8
Mg	24.8	50.6	20.0	36.1
	269.1	299.9	274.5	285.6

II.—Percentage composition.

	s	t	u	v
Cl	55.19	50.68	55.60	52.67
SO_4	12.67	20.17	9.54	15.52
Na	22.68	8.41	25.75	15.76
K	.25	3.87	1.82	3.41
Mg	9.21	16.87	7.29	12.64
	100.00	100.00	100.00	100.00

OREGON AND WASHINGTON.

A. Abert Lake, Oregon.[1] Specific gravity, 1.03117, at 19.8°. Water taken 1 foot below surface. Analysis by T. M. Chatard in 1887.

B. Harney Lake, Oregon. Analyses by George Steiger, 1902.

C. Soap Lake, Washington. Analysis by Steiger, 1892.

D. Omak Lake, Colville Indian Reservation, Washington. Specific gravity, 1.004 at 25°. Analysis by Steiger in 1914.

Analyses A, B, and C are stated in grams per liter; D is given in grams per kilogram. Columns a, b, c, and d give the percentage composition of the saline matter.

	A	a	B	b	C	c	D	d
SO_4	0.706	1.80	0.7733	7.38	4.3624	15.47	1.185	20.79
CO_3	6.006	15.33	1.0367	9.89	6.4194	22.77	1.979	34.69
HCO_3	3.538	9.03	1.9703	18.81	3.2586	11.55	.173	3.03
Cl	13.462	34.37	2.7713	26.45	3.5262	12.50	.166	2.91
K	.538	1.37	.1928	1.84	.....	.....	.254	4.45
Na	14.690	37.51	3.6045	34.40	10.5041	37.27	1.831	32.10
Ca	Undet.	.....	None.	None.	Trace.	Trace.	.013	.23
Mg	Undet.	.....	.0068	.06	.0108	.04	.103	1.80
B_4O_7	.....	.....	.0928	.89	.....	.....	None.	None.
SiO_2	.232	.59	.0287	.28	.1130	.40	.....	.....
	39.172	100.00	10.4772	100.00	28.1945	100.00	5.704	100.00

ALASKA.

A. Water of Yukon River, taken just above Eagle. Stated in parts per million.

a. Percentage composition of the dissolved salts. Analysis by George Steiger, in 1904.

	A	a
SO_4	10.5	8.84
CO_3	24.6	20.70
HCO_3	41.7	35.07
Cl	.4	.33
K	Trace.	Trace.
Na	6.0	5.05
Ca	21.7	18.25
Mg	4.6	3.86
$(Al, Fe)_2O_3$	1.8	1.51
SiO_2	7.6	6.39
	118.9	100.00

GULF OF MEXICO.

A. Sea water, taken 2 miles off Loggerhead Key, near the Tortugas. Specific gravity, 1.02434, at 25° C. Stated in grams per kilogram. Analysis by George Steiger in 1910.

a. Percentage composition of the dissolved salts.

	A	a
SO_4	2.7422	7.54
CO_3	.1257	.34
Cl	20.0762	55.24
Br	.0644	.17
K	.4000	1.10
Na	11.1957	30.80
Ca	.4420	1.22
Mg	1.3054	3.59
	36.3516	100.00

[1] Partial analysis of a very small sample.

ANALYSES OF MINE WATERS.

TENNESSEE.

Waters from Ducktown, collected by W. H. Emmons and analyzed by R. C. Wells in 1910. Three of these waters are noteworthy because of their content of ferrous iron.

A. No. 20 mine, near surface.

B. Same, at 55 feet depth.

C. Calloway shaft, near surface.

D. Same, at 37 feet depth.

E. Burra Burra mine.

F. East Tennessee mine.

All analyses stated in parts per million. In Table II, under a, b, c, etc., the percentage composition of the dissolved matter is given. Free sulphuric acid is stated as such.

I.—Parts per million.

	A	B	C	D	E	F
H_2SO_4	108.2	115.1	210.2	97.5	129.6	406.5
SO_4	444.0	416.4	415.8	476.8	6,664.0	2,068.0
Cl	.7	.6	.7	.4	.1	2.2
K	3.2	2.8	2.7	2.2	19.8	7.8
Na	3.1	3.0	5.2	5.5	23.4	5.9
Ca	18.1	18.4	19.7	30.4	67.6	238.0
Mg	12.2	11.5	5.2	6.2	40.6	63.3
Mn''	.3	.9	.2	.1	.2	.3
Fe''	Trace?	Trace?	71.4	89.2	2,178.0	1.3
Fe'''	29.9	31.3	20.3	55.9	None.	186.3
Al	40.1	46.5	14.5	19.1	433.0	165.0
Zn	6.1	4.2	2.4	2.9	199.8	54.3
Cu	12.8	12.0	28.1	11.0	312.1	40.8
SiO_2	20.6	19.1	37.0	49.9	55.6	78.9
	699.3	681.8	833.4	847.1	10,123.8	3,318.6

II.—Percentage composition.

	a	b	c	d	e	f
H_2SO_4	15.47	16.89	25.23	11.51	1.28	12.25
SO_4	63.49	61.08	49.90	56.28	65.82	62.32
Cl	.10	.09	.08	.05	.01	.08
K	.46	.41	.32	.26	.20	.23
Na	.44	.44	.62	.65	.23	.18
Ca	2.59	2.70	2.37	3.59	.66	7.17
Mg	1.74	1.69	.62	.73	.40	1.90
Mn''	.05	.13	.02	.01	.02	.01
Fe''	Trace?	Trace?	8.57	10.55	21.51	.04
Fe'''	4.27	4.59	2.43	6.60	None.	5.62
Al	5.75	6.82	1.74	2.25	4.27	4.97
Zn	.87	.60	.29	.34	1.97	1.63
Cu	1.83	1.76	3.37	1.29	3.08	1.22
SiO_2	2.94	2.80	4.44	5.89	.55	2.38
	100.00	100.00	100.00	100.00	100.00	100.00

MICHIGAN.

A. Water from the lower level of the Quincy mine, Hancock. Specific gravity 1.188. Analysis by George Steiger in 1905. Stated in grams per kilogram. A remarkable calcium chloride water.

a. Percentage composition of the dissolved solids.

	A	a
SO_4	0.0130	0.01
CO_3	.0140	.01
Cl	134.9000	63.55
Na	11.9500	5.63
Ca	65.3500	30.78
Mg	.0230	.01
Cu	.0011	Trace.
SiO_2	.0200	.01
	212.2711	100.00

MISSOURI AND OKLAHOMA.

A. Water from southwest shaft, B. & C. mine, west of Joplin, Mo. Sample from 187 feet depth. Analysis by H. N. Stokes in 1902.

B. Water from pump shaft, Missouri Zinc Fields,[1] near Webb City.

C. Water from Alabama Coon mine, Missouri Zinc Fields.

Analyses B and C by Stokes, 1903.

D. Water from L. E. Church mine, Miami, Okla. Analysis by R. C. Wells, 1911. Traces of thiosulphates present.

All analyses stated in parts per million. Under a, b, c, and d, in Table II, the percentage composition of the dissolved substances is given.

I.—Parts per million.

	A	B	C	D
SO_4	140.8	2,671.5	6,153.2	Trace.
HCO_3	277.0	.....	.....	163.5
Cl	3.1	6.6	2.7	117.8
K	1.4	4.5	.5	Trace.
Na	9.2	47.1	49.9	95.8
Li	Trace.	Trace.	None.	.....
Ca	127.1	595.8	345.3	30.2
Mg	8.7	56.7	25.2	7.2
Fe	Trace.	269.1	474.6	.2
Al	Trace.	8.4	142.1	
Mn	.....	3.2	1.7	.....
Cu	Trace.	Trace.	3.7	.....
Zn	1.3	445.0	2,412.0	.....
Cd	.....	1.0	9.0	.....
SiO_2	14.9	35.6	107.6	11.7
H_2S	None.	.....	.....	5.8
	583.5	4,144.5	9,727.5	432.2

II.—Percentage composition.

	a	b	c	d
SO_4	24.13	64.46	63.26	Trace.
HCO_3	47.48	.....	.....	37.83
Cl	.53	.16	.03	27.26
K	.24	.11	Trace.	Trace.
Na	1.58	1.13	.51	22.17
Li	Trace.	Trace.	None.	.....
Ca	21.78	14.38	3.55	6.99
Mg	1.49	1.37	.26	1.65
Fe	Trace.	6.49	4.88	.04
Al	Trace.	.20	1.46	
Mn	.....	.08	.02	.....
Cu	Trace.	Trace.	.04	.....
Zn	.22	10.74	24.79	.....
Cd	.....	.02	.09	.....
SiO_2	2.55	.86	1.11	2.71
H_2S	None.	.....	.....	1.35
	100.00	100.00	100.00	100.00

[1] A definite tract of 400 acres.

MONTANA.

Seven waters from Butte, analyzed by W. F. Hillebrand in 1887 and 1902.

A. Glengarry mine. Sample taken at 220 feet depth.

B. Anaconda mine. At 800 feet depth.

C. Gagnon mine. At 1,125 feet depth.

D. Nettie mine. At 300 feet depth.

E. St. Laurence mine. At 1,200 feet depth.

F. Mountain View mine. Specific gravity, 1.1317 at 15° C. At second level.

G. Green Mountain mine. Specific gravity, 1.00105 at 15° C. At 2,200 feet depth. Water from country rock.

All analyses stated in parts per million. In Table II the percentage composition of the dissolved solids is given. In that table quantities less than 0.01 per cent are regarded as traces.

I.—Parts per million.

	A	B	C	D	E	F	G
SO_4	544.7	90.6	593.4	67.2	2,672.0	71,053.3	406.5
CO_3	.....	.....	8.8	.....	.....	.....	.....
HCO_3	.....	.....	92.7	.....	.....	.....	78.1
Cl	118.5	11.8	842.8	15.0	13.0	17.7	6.8
PO_4	Trace.	Trace.	Trace.	Trace.	Trace.	1.5	Trace.
AsO_4	Trace?	Trace?	None.	Trace?	.....	Trace.	Trace.
K	30.5	3.5	11.4	5.0	13.1	6.8	7.1
Na	176.9	11.1	82.8	30.1	39.6	41.7	16.2
Li	.....	.....	.....	.....	.....	Trace.	Trace.
Ca	92.7	49.0	512.1	39.1	132.5	307.7	151.2
Mg	17.9	10.3	102.6	6.7	61.6	149.2	28.2
Al	.....	.....	.....	.....	83.5	85.2	None.
Fe	1.4	.9	.4	.4	159.8	49.8	1.8
Mn	Trace.	2.5	1.4	.8	12.0	13.2	.5
Ni	.....	.....	.....	.....	} .5	3.5	.....
Co	.....	.....	.....	.....		4.6	.....
Cu	.4	Trace.	Trace.	None.	59.1	45,633.2	Trace.
Zn	1.8	1.9	None.	Trace?	852.0	411.2	.3
Cd	.....	.....	.....	.....	41.1	.....	.....
Pb	Trace.	Trace?	None.	None.	.....	.....	.....
Sn	.....	.....	.....	.....	17.0	.....	.....
SiO_2	27.2	36.1	29.5	55.8	47.7	67.4	23.2
	1,012.0	217.7	2,277.9	220.1	4,204.5	117,846.0	719.9
Free CO_2	167.2	59.9	.....	102.0	23.7	8.9	27.2

II.—Percentage composition.

	a	b	c	d	e	f	g
SO_4	53.82	41.62	26.05	30.53	63.55	60.29	56.47
CO_3	.....	.....	.39	.....	.....	.....	.....
HCO_3	.....	.....	4.07	.....	.....	.....	10.85
Cl	11.71	5.42	37.00	6.82	.31	.01	.94
PO_4	Trace.	Trace.	Trace.	Trace.	Trace.	Trace.	Trace.
AsO_4	Trace?	Trace?	None.	Trace?	.....	Trace.	Trace.
K	3.01	1.61	.50	2.27	.32	Trace.	.99
Na	17.48	5.10	3.63	13.68	.94	.04	2.25
Li	.....	.....	.....	.....	.....	Trace.	Trace.
Ca	9.16	22.51	22.49	17.76	3.16	.26	21.00
Mg	1.77	4.72	4.50	3.05	1.46	.13	3.92
Al	.....	.....	.....	.....	1.98	.09	None.
Fe	.14	.41	.02	.18	3.80	.04	.25
Mn	Trace.	1.15	.06	.36	.28	.01	.07
Ni	.....	.....	.....	.....	} .01	Trace.	.....
Co	.....	.....	.....	.....		Trace.	.....
Cu	.04	Trace.	Trace.	None.	1.40	38.72	Trace.
Zn	.18	.88	None.	Trace?	20.27	.35	.04
Cd	.....	.....	.....	.....	.98	.....	.....
Pb	Trace.	Trace.	None.	None.	.....	.....	.....
Sn	.....	.....	.....	.....	.40	.....	.....
SiO_2	2.69	16.58	1.29	25.35	1.14	.06	3.22
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

COLORADO AND UTAH.

A. Water from Geyser mine, Silver Cliff, Colorado. 450 feet down.

B. Same, 2,000 feet down. Analyses A and B by W. F. Hillebrand in 1895.

C. Water from Emma lower tunnel, Dunton, Colorado. 500 feet down. Analysis by H. N. Stokes, 1899.

D. Water from Bachellor mine, Creede, Colorado.

E. Water from Solomon mine, Creede. Analyses D and E by Chase Palmer, 1911.

F. Water from Gemini mine, Tintic, Utah. 1,650 feet down. Analysis by Palmer, 1912.

All analyses stated in parts per million. The percentage composition of the dissolved substances is given under a, b, c, etc., in Table II.

I.—Parts per million.

	A	B	C	D	E	F
SO_4	43.2	161.70	74.76	60.12	104.4	124.0
CO_3	59.7					12.0
HCO_3	103.1	3,077.32	1,370.20	62.83	73.8	265.2
Cl	7.9	186.40	1.61	Trace.	1.6	121.4
Br		Trace.				
I		Trace.				
F		Trace.				
NO_3		1.60				
PO_4		Trace.				
B_4O_7		Trace.	Trace.			
K	10.6	198.00	4.24	2.41	3.5	75.6
Na	36.4	719.45	20.91	28.51	7.5	
Li	Trace.	2.85	Trace.			
Ca	37.4	146.41	365.50	17.36	46.2	115.9
Sr		1.95	2.96			
Mg	12.3	177.67	54.44	1.30	7.3	21.5
Fe	.7	3.50	2.19	2.10	1.2	Trace.
Al_2O_3	.8	1.06	None.			Trace.
Mn	.8	.57	2.58	.25	3.2	
Cu	Trace.	.02	Trace.	None.	None.	None.
Zn	.2	.34				
Pb	Trace.	1.35				None.
SiO_2	25.9	24.42	15.50	32.25	23.2	24.4
	339.0	4,704.61	1,914.89	207.13	271.9	760.0

II.—Percentage composition.

	a	b	c	d	e	f
SO_4	12.77	3.44	3.90	29.03	38.39	16.32
CO_3	17.61					1.58
HCO_3	30.41	65.42	71.56	30.34	27.15	34.90
Cl	2.33	3.96	.08	Trace.	.59	15.96
Br		Trace.				
I		Trace.				
F		Trace.				
NO_3		.03				
PO_4		Trace.				
B_4O_7		Trace.	Trace.			
K	3.12	4.21	.22	1.16	1.28	9.95
Na	10.74	15.29	1.09	13.77	2.76	
Li	Trace.	.06	Trace.			
Ca	11.03	3.11	19.09	8.38	17.00	15.25
Sr		.04	.15			
Mg	3.63	3.78	2.84	.62	2.68	2.83
Fe	.20	.07	.12	1.01	.43	Trace.
Al_2O_3	.23	.02	None.			Trace.
Mn	.23	.01	.14	.12	1.18	
Cu	Trace.	Trace.	Trace.	None.	None.	None.
Zn	.06	.01				
Pb	Trace.	.03				None.
SiO_2	7.64	.52	.81	15.57	8.54	3.21
	100.00	100.00	100.00	100.00	100.00	100.00

NEVADA AND ARIZONA.

A. Hot water from a bore hole 2,316 feet deep in the Mizpah mine, Tonopah, Nevada. Analysis by R. C. Wells in 1910.

B. Water from the Brooks mine, Kimberly, Nevada. Analysis by Chase Palmer in 1910.

C. Water from the 1,000-foot level, Contention mine, Tombstone, Arizona. Analysis by R. C. Wells, 1911.

All analyses stated in parts per million. Under a, b, and c, in the same table, the percentage composition of the dissolved substances is given.

	A	a	B	b	C	c
SO_4	327.2	39.70	256.0	39.53	30.3	7.68
CO_3	10.6	1.29				
HCO_3	157.2	19.08	156.0	24.09	217.4	55.11
Cl	35.6	4.32	8.5	1.31	12.3	3.12
NO_3	Trace.	Trace.				
K	3.4	.41	11.0	1.70	3.7	.94
Na	148.8	18.05	35.0	5.41	18.9	4.79
Ca	68.8	8.35	126.0	19.46	58.8	14.89
Mg	6.3	.77	Trace.	Trace.	8.2	2.07
Al	.7	.08	None.	None.		
Fe	.7	.08				
Fe_2O_3			27.0	4.17		
Zn	Trace.	Trace.				
SiO_2	64.8	7.87	28.0	4.33	45.0	11.40
	824.1	100.00	647.5	100.00	394.6	100.00
Free CO_2					15.2	

CALIFORNIA.

A. Water from the Hermann shaft, Sulphur Bank.

B. Water from the Parrott shaft, Sulphur Bank.

Analyses A and B by W. H. Melville, given by G. F. Becker in U. S. Geol. Survey Mon. 13, p. 259, 1888.

C. Water from Federal Loan mine, Nevada City.

D. Water from Black Prince mine, Nevada City.

Analyses C and D by W. F. Hillebrand in 1895.

All analyses stated in milligrams per liter. The percentage composition of the dissolved matter is given in Table II.

I.—Milligrams per liter.

	A	B	C	D
SO_4	16.45	465.84	7.70	7.80
CO_3	782.86			
HCO_3	727.59	445.63	144.16	149.04
Cl	691.57	666.77	3.16	3.10
B_4O_7	1,450.65	1,856.82		
K	24.63	38.89	1.00	1.60
Na	1,706.12	1,319.52	13.40	13.70
NH_4	2.50	1.06		
Ca	21.02	20.22	33.60	44.35
Mg	5.40	1.59	5.70	3.35
Mn			.27	1.90
Fe		.48		
$(Al, Fe)_2O_3$			4.20	1.80
Pb			Trace.	Trace?
As			None.	Trace?
SiO_2	37.15	41.85	32.70	41.40
H_2S	4.55	.74		
S			1.10	
Organic	5.00	7.60		
	5,475.49	4,867.01	246.99	268.04
Free CO_2		1,590.59		

II.—Percentage composition.

	a	b	c	d
SO_4	0.30	9.57	3.12	2.91
CO_3	14.30			
HCO_3	13.29	9.15	58.36	55.61
Cl	12.63	13.70	1.28	1.15
B_4O_7	26.49	38.15		
K	.45	.80	.41	.60
Na	31.16	27.11	5.43	5.11
NH_4	.05	.02		
Ca	.38	.42	13.60	16.55
Mg	.10	.03	2.31	1.25
Mn			.11	.71
Fe		.01		
$(Al, Fe)_2O_3$			1.70	.67
Pb			Trace.	Trace?
As			None.	Trace?
SiO_2	.68	.86	13.24	15.44
H_2S	.08	.02		
S			.44	
Organic	.09	.16		
	100.00	100.00	100.00	100.00