DEPARTMENT OF THE INTERIOR

BULLETIN

OF THE

UNITED STATES

GEOLOGICAL SURVEY

No. 9

A REPORT OF WORK DONE IN THE WASHINGTON LABORATORY DURING THE FISCAL YEAR 1883-'84

WASHINGTON
GOVERNMENT PRINTING OFFICE
1884

ADVERTISEMENT.

(Bulletin No. 9.)

The publications of the United States Geological Survey are issued in accordance with the statute, approved March 3, 1879, which declares that—

"The publications of the Geological Survey shall consist of the annual report of operations, geological and economic maps illustrating the resources and classifications of the lands, and reports upon general and economic geology and paleontology. The annual report of operations of the Geological Survey shall accompany the annual report of the Secretary of the Interior. All special memoirs and reports of said Survey shall be issued in uniform quarto series if deemed necessary by the Director, but otherwise in ordinary octavos. Three thousand copies of each shall be published for scientific exchanges and for sale at the price of publication; and all literary and cartographic materials received in exchange shall be the property of the United States and form a part of the library of the organization. And the money resulting from the sale of such publications shall be covered into the Treasury of the United States."

On July 7, 1882, the following joint resolution, referring to all Government publications, was passed by Congress:

"That, whenever any document or report shall be ordered printed by Congress, there shall be printed, in addition to the number in each case stated, the 'usual number' [1,900] of copies for binding and distribution among those entitled to receive them."

Under these general laws it will be seen that none of the Survey publications are furnished to it for gratuitous distribution. The 3,000 copies of the Annual Report are distributed through the document rooms of Congress. The 1,900 copies of each of the publications are distributed to the officers of the legislative and executive Departments and to stated depositories throughout the United States.

Except, therefore, in those cases where an extra number of any publication is supplied to this office by special resolution of Congress, as has been done in the case of the Second, Third, Fourth, and Fifth Annual Reports, or where a number has been ordered for its use by the Secretary of the Interior, as in the case of Williams's Mineral Resources, the Survey has no copies of any of its publications for gratuitous distribution.

ANNUAL REPORTS.

Of the Annual Reports there have been already published:

I. First Annual Report to the Hon. Carl Schurz, by Clarence King. 1880. 8°. 79 pp. 1 map.—A preliminary report describing plan of organization and publications.

II. Report of the Director of the United States Geological Survey for 1880–'81, by J. W. Powell. 1882. 8°. lv, 588 pp. 61 pl., 1 map.

III. Third Annual Report of the United States Geological Survey, 1881–'82, by J. W. Powell. 1883. 8°. xviii, 564 pp.. 67 pl. and maps.

IV. Fourth Annual Report of the United States Geological Survey, 1882–'83, by J. W. Powell. 1884. 8°. xii, 473 pp. 85 pl. and maps.

The Fifth Annual Report is in press.

MONOGRAPHS.

So far as already determined upon, the list of the Monographs is as follows:

I. The Precious Metals, by Clarence King. In preparation.

II. Tertiary History of the Grand Cañon District, with atlas, by Capt. C. E. Dutton. Published.

III. Geology of the Comstock Lode and Washoe District, with atlas, by George F. Becker. Published.

IV. Comstock Mining and Miners, by Eliot Lord. Published.

V. Copper-bearing Rocks of Lake Superior, by Prof. R. D. Irving. Published.

VI. Older Mesozoic Flora of Virginia, by Prof. William M. Fontaine. Published.

VII. Silver-lead Deposits of Eureka, Nevada, by Joseph S. Curtis. Published.

VIII. Paleontology of the Eureka District, Nevada, by Charles D. Walcott. In press.

IX. Brachiopoda and Lamellibranchiata of the Green Marls and Clays of New Jersey, by R. P. Whitfield.

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Geology and Mining Industry of Leadville, with atlas, by S. F. Emmons. In preparation.

Geology of the Eureka Mining District, Nevada, with atlas, by Arnold Hague. In preparation.

Lake Bonneville, by G. K. Gilbert. In preparation.

Dinocerata. A monograph on an extinct order of Ungulates, by Prof. O. C. Marsh. In preparation.

Sauropoda, by Prof. O. C. Marsh. In preparation.

Stegosauria, by Prof. O. C. Marsh. In preparation.

Of these Monographs, Nos. II, III, IV, V, VI, and VII are now published, viz:

II. Tertiary History of the Grand Cañon District, with atlas, by C. E. Dutton, Capt. U. S. A. 1882. 4°. 264 pp. 42 pl. and atlas of 26 double sheets folio. Price $10.12.

III. Geology of the Comstock Lode and Washoe District, with atlas, by G. F. Becker. 1882. 4°. xv, 422 pp. 7 pl. and atlas of 21 sheets folio. Price $11.

IV. Comstock Mining and Miners, by Eliot Lord. 1883. 4°. xvi, 451 pp. 3 pl. Price $1.50.

V. Copper-bearing Rocks of Lake Superior, by Prof. R. D. Irving. 1883. 4°. xiv, 464 pp. 29 pl. Price $—.

VI. Contributions to the Knowledge of the Older Mesozoic Flora of Virginia, by William M. Fontaine. 1883. 4°. xi, 144 pp. 54 l. 54 pl. Price $—.

VII. Silver-lead Deposits of Eureka, Nevada, by Joseph S. Curtis. 1884. 4°. xiii, 200 pp. 15 pl. Price $—.

Nos. VIII and IX are in press and will soon appear. The others, to which numbers are not assigned, are in preparation.

BULLETINS.

The Bulletins of the Survey will contain such papers relating to the general purpose of its work as do not properly come under the heads of Annual Reports or Monographs.

Each of these Bulletins will contain but one paper, and be complete in itself. They will, however, be numbered in a continuous series, and will in time be united into volumes of convenient size. To facilitate this, each Bulletin will have two paginations, one proper to itself and one which belongs to it as part of the volume.

Of this series of Bulletins, Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9 are already published, viz:

1. On Hypersthene-Andesite and on Triclinic Pyroxene in Augitic Rocks, by Whitman Cross, with a Geological Sketch of Buffalo Peaks, Colorado, by S. F. Emmons. 1883. 8°. 42 pp. 2 pl. Price 10 cents.

2. Gold and Silver Conversion Tables, giving the coining value of Troy ounces of fine metal, &c., by Albert Williams, jr. 1883. 8°. ii, 8 pp. Price 5 cents.

3. On the Fossil Faunas of the Upper Devonian along the meridian of 76° 30′, from Tompkins County, New York, to Bradford County, Pennsylvania, by Henry S. Williams. 1884. 8°. 36 pp. Price 5 cents.

4. On Mesozoic Fossils, by Charles A. White. 1884. 8°. 36 pp. 9 pl. Price 5 cents.

5. A Dictionary of Altitudes in the United States, compiled by Henry Gannett. 1884. 8°. 325 pp. Price 20 cents.

6. Elevations in the Dominion of Canada, by J. W. Spencer. 1884. 8°. 43 pp. Price 5 cents.

7. Mapoteca Geologica Americana. A Catalogue of Geological Maps of America (North and South), 1752–1881, by Jules Marcou and John Belknap Marcou. 1884. 8°. 84 pp. Price 10 cents.

8. On Secondary Enlargement of Mineral Fragments in Certain Rocks, by R. D. Irving and C. R. Van Hise. 1884. 8°. 56 pp. Price 10 cents.

9. A Report of Work done in the Washington Laboratory during the fiscal year 1883–'84. F. W. Clarke, chief chemist; T. M Chatard, assistant. 1884. 8°. 40 pp. Price 5 cents.

STATISTICAL PAPERS.

A fourth series of publications having special reference to the mineral resources of the United States is contemplated; of that series the first has been published, viz: Mineral Resources of the United States, by Albert Williams, jr. 1883. 8°. xvii, 813 pp. Price 50 cents.

Correspondence relating to the publications of the Survey, and all remittances, which must be by postal note or money order, should be addressed to the

DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C.

WASHINGTON, D. C., *August* 30, 1884.

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J. W. POWELL DIRECTOR

A REPORT OF WORK DONE

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DURING THE

FISCAL YEAR 1883-'84

F. W. CLARKE CHIEF CHEMIST
T. M. CHATARD ASSISTANT CHEMIST

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CONTENTS.

INTRODUCTORY.

The present bulletin contains the more important results obtained in the chemical laboratory of the United States Geological Survey at Washington, between December 12, 1883, and June 30, 1884. The work here reported was almost wholly done by Dr. T. M. Chatard and myself, and represents the first fiscal year of our laboratory organization. Other work, carried forward in this laboratory by Dr. F. A. Gooch, and relating mainly to the rocks and waters of the Yellowstone National Park, is reserved for a future bulletin.

In addition to the analyses here published, a considerable number of assays, mineral determinations, and qualitative examinations have been made. Several researches have also been begun, but are not yet advanced enough to warrant any announcement. Other bulletins will be issued from time to time, as fast as material accumulates.

F. W. CLARKE.

WORK DONE IN THE WASHINGTON LABORATORY DURING THE FISCAL YEAR 1883-'84.

MINERAL, ROCK, AND ORE ANALYSES.

The mineralogical work of the division of chemistry has been done in close co-operation with the mineral department of the National Museum. Some of the material studied has been received through the latter institution; some has been brought in by field parties of the Survey; some represents our own summer collecting. The rocks, clays, etc., analyzed, have been submitted by other divisions of the survey, and will not be specially discussed in this bulletin. The only novelty in the methods of analysis has been in the use of the bismuth oxide process for the estimation of the alkalies in silicates. This process, as modified by Dr. Chatard, is described later.

GAHNITE FROM GILMORE'S MICA MINE, MOUNTGOMERY COUNTY, MARYLAND.

The locality at which this mineral was found is 12 miles north of Washington, near Colesville, Maryland. The mine has yielded a considerable quantity of merchantable mica, which occurs in the usual granite vein, associated with quartz, albite, garnet, black tourmaline, and beryl. The last-named mineral is abundant in large but ill-formed crystals. But one specimen of the gahnite was obtained; a dark-green massive specimen, filling a cavity in altered feldspar. Specific gravity 4.59. Analysis by T. M. Chatard:

Ignition	30
SiO_2	57
Al_2O_3	55.46
Fe_2O_3	2.77
ZnO	40.07
MgO	59
CuO	undet.
	99.76

JADE AND PECTOLITE FROM ALASKA.

Among the Eskimo implements collected by the U. S. Signal Service at Point Barrow, Alaska, were a considerable number of a material which appeared to be jade. Of these there were two varieties; one pale apple-green, the other dark-green; both were highly polished, and exceedingly compact and tough. The specific gravity of the pale-green variety was 2.873, that of the dark material was 3.012. Analyses (Clarke) gave results as follows:

	Pale-green.	Dark-green.
H_2O	4.09	1.41
SiO_2	53.94	57.01
FeO	trace.	6.95
CaO	32.21	12.75
MgO	1.43	21.36
Al_2O_3	0.58	0.42
Na_2O	8.57	
	100.82	99.90

The dark-green material is plainly jade, or nephrite, quite analogous in composition to that from the Swiss lake dwellings. The light-green mineral, on the other hand, agrees in composition with pectolite. It is easily fusible, and has, in short, all the essential properties of pectolite. It is, therefore, a new and interesting variety of that well-known species.

The Eskimo of Point Barrow say that the jade and jade-like minerals used by them come from some point to the eastward. The locality itself, we believe, has not yet been visited by civilized men. Whether both minerals are found at the same place or not cannot be stated; but we hope that before long more definite information may be secured.

SAUSSURITE FROM CALIFORNIA.

Found in a gabbro collected by Mr. J. S. Diller, thirty-seven miles north of Pit River Ferry, Shasta County. The mineral is nearly white, with a greenish-gray cast, and has a specific gravity of 3.148. Associated with green diallage. Analysis by F. W. Clarke:

Ignition	2.42
SiO_2	42.79
Al_2O_3	29.43
CaO	18.13
FeO	3.65
MgO	1.40
Na_2O	2.51
	100.33

ALLANITE FROM TOPSHAM, MAINE.

Abundant in slender black prisms at Sprague's granite quarry. The crystals are usually much rusted upon the surface, and are known to the local quarrymen as "nails." Analysis by F. W. Clarke:[1]

H_2O	4.13
SiO_2	34.97
Al_2O_3	12.83
FeO	18.11
MnO	2.82
Ce_2O_3, La_2O_3, Di_2O_3	17.26
CaO	7.21
MgO	1.40
	98.73

[1] Compare analysis by F. C. Robinson, Amer. Jour. Sci., May, 1884.

The ferrous oxide carries with it some ferric oxide. As the analysis was made merely for the complete identification of the species, the troublesome separation of the cerium group oxides was not considered necessary. The mineral appears to vary considerably in different parts of the quarry.

BERYL FROM GREENE COUNTY, TENNESSEE.

A typical, bluish-green translucent beryl. Analysis by F. W. Clarke:

SiO_2	65.39
GlO	13.35
Al_2O_3 (tr. FeO)	19.10
Ignition	1.76
	99.60

DAMOURITE FROM STONEHAM, ME.

Two specimens of a micaceous mineral from the topaz locality at Stoneham, collected by Mr. N. H. Perry, of South Paris, and sent by him to the National Museum, have been examined and prove to be different forms of damourite.

A. Subfibrous compact, light grayish green in color, greasy luster, associated with albite and topaz.

B. Broadly foliated micaceous, light grayish green, strong mother-of-pearl luster, also associated with topaz. Analyses (Chatard) as follows:

	A.	*B.*
Ignition	4.48	4.78
SiO_2	45.19	45.34
Al_2O_3	33.32	33.96
FeO	4.25	3.96
MnO	0.58	0.51
CaO	trace.	0.22
MgO	0.36	0.10
Na_2O	1.57	1.49
K_2O	11.06	10.73
	100.81	101.09

MARGARITE.

A. From Soapstone Hill, near Gainesville, Georgia. Bright pistachio green, subfibrous aggregate of extremely minute scales surrounding and radiating from a core of bright rose-pink corundum which is in places interlaminated by the margarite. A very handsome specimen on account of the contrast of color. From Mr. Theodore Moreno, of Gainesville, Georgia. G. = 3.00; H. = 3.5. Analysis (T. M. Chatard):

H_2O	4.88
SiO_2	31.72
Al_2O_3	50.03
FeO	trace.
CaO	11.57
MgO	0.12
Na_2O	2.26
	100.58

B. An altered crystal of corundum from Iredell County, North Carolina, showing a core of corundum surrounded by a yellowish-white, semi-micaceous, compact mineral more or less intermixed with small needles of black tourmaline. Analysis (Chatard) shows the micaceous mineral to be a margarite similar to that described by Dr. F. A. Genth as occurring at Hendrick's farm in the same county.

H_2O	5.68
SiO_2	31.15
Al_2O_3	49.51
CaO	11.13
MgO	0.45
Na_2O	2.74
	100.66

CIMOLITE FROM NORWAY, MAINE.

Among a collection of Maine minerals received from N. H. Perry, of South Paris, were several specimens of tourmaline and albite encrusted with a pink to rose-purple, earthy, alteration product. The color was found to be due to a little manganese, which was not, however, separately estimated. The analysis (Clarke) gave results approaching to those required by the rational formula $AlH_3(SiO_3)_3$, as the subjoined figures show:

	Found.	Theory.
H_2O	9.53	10.4
SiO_2	70.06	69.8
Al_2O_3 (with MnO)	17.19	19.8
Na_2O	2.28	....
MgO	0.80	....
	99.86	100.0

It will be observed at once that these results do not agree exactly with those commonly obtained for cimolite. They are too high in silica, and too low in water, and the formula deduced from them is somewhat novel. We are inclined to place the mineral, however, under cimolite, as being nearer to that species than to any other. Possibly the new formula represents the final outcome of an alteration process which ordinary cimolite has only partially undergone. Somewhat similar pink alteration products are not uncommon in the albitic granite veins of Maine and New Hampshire, and some, without analysis, have been supposed to be montmorillonite, like that of Branchville, Connecticut. A more thorough examination of such products is much to be desired.

HALLOYSITE FROM CALIFORNIA.

Collected by Ensign J. B. Bernadou, at the Detroit Copper Mine, near Mono Lake. The specimens consisted of irregular lumps, covered and seamed with a black coating of the oxides of copper and manganese.

The color of the pure mineral was white, with a very faint tinge of blue. Analysis by F. W. Clarke.

H_2O	18.95
SiO_2	42.91
Al_2O_3	38.13
	99.99

PROCHLORITE.

A dark-green chlorite, collected by Mr. G. P. Merrill on Foundry Run, Georgetown, D. C., may be assigned to the above-named species. The mineral is very dark in color, scaly-crystalline, and occurs in quite fine specimens. Analysis by F. W. Clarke.

H_2O	14.43
SiO_2	25.45
MgO	15.04
Al_2O_3	17.88
FeO	24.98
Na_2O	0.67
	98.45

The iron is all reckoned as ferrous iron, although part of it is undoubtedly ferric.

SO-CALLED "ALUM ROCK" FROM GRANT COUNTY, NEW MEXICO.

Six samples were received from Hon. W. S. Rosecrans. The material is found at the headwaters of the Gila River, about 40 miles north of Silver City, and is said to cover about 2,000 acres. The specimens may be described as follows:

A. Pinkish crusts.
B. Yellowish crusts.
C. Drab crusts.
D. White crusts.
E. Fibrous mineral of silky luster.
F. "Gray alum rock."

Analyses by F. W. Clarke.

A.

Al_2O_3	15.52
SO_3	34.43
H_2O	42.56
Insoluble residue	7.62
	100.13

This substance is alunogen. So, also, but impure, containing iron, are B, C, and D. Of these only rough analyses were made.

	B.	C.	D.
Ignition	16.20	71.28	55.41
$Al_2O_3+Fe_2O_3$	4.95	15.81	9.19
Insoluble residue	78.95	12.27	33.19
	100.10	99.36	97.79

The analysis of E shows it to be halotrichite. Only a trace of ferric iron is present. Color nearly white, slightly grayish. Asbestiform.

E.

Al_2O_3	7.27
FeO	13.59
SO_3	37.19
H_2O	40.62
Insoluble	0.50
	99.17

F, which was not analyzed, is merely an impure mixture of alunogen and halotrichite.

SCORIACEOUS OBSIDIAN, SOUTHEAST SIDE OF MONO VALLEY, CALIFORNIA.

A grayish-white rock which forms a large portion of the Mono craters. Collected by I. C. Russell. Analysis by T. M. Chatard.

Ignition	2.20
SiO_2	74.05
Al_2O_3 (trace Fe_2O_3)	13.85
CaO	0.90
MgO	0.07
K_2O	4.31
Na_2O	4.60
	99.98

WHITE POWDER FROM LAHONTAN LAKE-BEDS, TRUCKEE RIVER.

A volcanic dust which fell in the quaternary Lake Lahontan. Supposed to have been erupted from the Mono craters. Collected by I. C. Russell. Analysis by T. M. Chatard.

H_2O	3.91
SiO_2	71.15
Al_2O_3 ($+Fe_2O_3$)	15.95
CaO	0.85
MgO	0.41
MnO	trace.
K_2O	3.36
Na_2O	4.94
	100.57

MARL FROM "WHITE TERRACE," 3 MILES WEST OF MULLEN'S SPRINGS, WEST SHORE OF PYRAMID LAKE, NEVADA.

Mostly deposited from the waters of the prehistoric Lake Lahontan. Collected by I. C. Russell. Analysis by T. M. Chatard.

$CaCO_3$	64.82
SiO_2	22.00
Al_2O_3	5.14
Fe_2O_3	2.04
CaO	0.93
MgO	1.89
H_2O	3.32
	100.14

TWO CLAYS FROM HUMBOLDT RIVER BRIDGE, MILL CITY, NEVADA.

A. From Upper Lahontan Lake-beds. B. From Lower Lahontan Lake-beds. Collected by I. C. Russell. Analyzed by T. M. Chatard. Color in both cases grayish.

	A.	B.
Ignition	9.78	13.03
SiO_2	56.30	50.70
Al_2O_3	16.52	*19.01
Fe_2O_3	5.08	....
CaO	5.45	10.26
MgO	2.64	3.19
K_2O	2.17	2.16
Na_2O	2.60	1.91
	100.54	100.26

* With a little Fe_2O_3.

BASALT FROM MOUNT THIELSON, OREGON.

Material collected by J. S. Diller; by whom also the lithological separations were made. Analyses of rock and component parts as follows:

A. Basalt. F. W. Clarke.
B. Groundmass. T. M. Chatard.
C. Hypersthene. T. M. Chatard.
D. Feldspar, specific gravity, 2.637–2.714. T. M. Chatard.
E. Feldspar, specific gravity, 2.714–2.877. T. M. Chatard.

	A.	B.	C.	D.	E.
Ignition	.60	.52	....	.40	.66
SiO_2	55.68	53.85	53.31	51.95	55.48
TiO_2	undet.	....	....	trace.	.30
Al_2O_3	18.93	22.95	5.99	28.84	26.91
Fe_2O_3	} 8.73	4.59	{	2.24	2.32
FeO			13.43	....	....
CaO	7.99	8.41	3.69	11.42	8.11
MgO	4.86	3.08	21.69	1.34	2.27
Na_2O	2.12	2.16	....	3.22	3.14
K_2O	.48	2.67	....	.59	.72
	99.39	100.23	98.11	100.00	100.00

In B a trace of P_2O_5 was found, and in C a trace of manganese. D and E are near labradorite, and are evidently mixtures. C, D, and E were received in very small quantities; not sufficient for full analysis. D and E therefore were treated with hydrofluoric acid, in order to render possible the estimation of the alkalies, and silica was taken by difference.

Less than half a gramme of a fulgurite, formed by the fusion of this basalt by lightning, was also partially analyzed. The results (Clarke) are as follows:

Ignition	1.11
SiO_2	55.04
Al_2O_3 } Fe_2O_3 }	28.99
CaO	7.86
MgO	5.85
Alkalies	undet.
	98.85

BASALT FROM PIT RIVER, NORTH OF BURNEY VALLEY, CALIFORNIA.

Collected by J. S. Diller. Analysis by F. W. Clarke.

Ignition	1.54
SiO_2	51.92
Al_2O_3	19.76
FeO (includes a little Fe_2O_3)	11.21
CaO	9.30
MgO	3.38
Na_2O	2.16
K_2O	0.60
	99.87

DACITES FROM LASSEN'S PEAK, CALIFORNIA.

Collected by J. S. Diller. Analyses by T. M. Chatard.

A. Gray dacite.

B. Reddish dacite.

C. Inclusion in dacite.

	A.	B.	C.
Ignition	0.56	0.44	1.35
SiO_2	69.51	68.20	58.97
Al_2O_3	15.75	16.98	18.60
Fe_2O_3	3.34	3.75	5.94
CaO	1.71	4.33	2.84
MgO	2.09	2.07	6.89
Na_2O	3.89	2.98	3.05
K_2O	3.34	1.52	2.24
P_2O_5	trace	....	undet.
	100.19	100.27	99.88

TWO SAMPLES OF LIMESTONE FROM MOUNDSVILLE NARROWS, TWELVE MILES BELOW WHEELING, W. VA.

A. Upper ledge. B. Lower ledge. Analyses by T. M. Chatard.

	A.	B.
Moisture	0.05	0.10
Insoluble	10.33	1.53
CO_2	39.18	43.16
CaO	48.02	53.26
MgO	1.08	0.93
Fe_2O_3	0.90	0.96
MnO and P_2O_5	traces	traces
	99.56	99.94

EQUIVALENT TO—

Moisture	0.05	0.10
$CaCO_3$	85.75	95.10
$MgCO_3$	2.26	1.95
$FeCO_3$	0.73	0.79
Sand, clay, and Fe_2O_3	10.77	2.00
	99.56	99.94

MAGNETIC IRON ORE FROM NEAR BOZEMAN, MONTANA.

Found in the Gallatin Range, between Middle and Bozeman Creeks, southwest of Bozeman.

Received from A. C. Peale. Analysis by T. M. Chatard.

Insoluble (SiO_2)	0.165
Fe_3O_4	96.49
FeS_2 ($S=0.171$)	0.321
Al_2O_3	0.04
MnO	0.93
CaO	trace.
MgO	0.072
TiO_2	2.71
P_2O_5	0.012
	100.740

The titanium was determined in a separate portion, and is probably high from presence of iron.

LIMONITE FRON CANAAN MT., TUCKER COUNTY, W. VA.

Analysis by T. M. Chatard.

Fe_2O_3	80.53
Moisture	13.20
SiO_2	1.95
P_2O_5	1.98
S	trace.
CaO	2.34
MnO	none.
	100 00

COAL FROM CRANSTON, R. I.

Analysis by F. A. Gooch. Specific gravity, 2.209 at 150.

Water	0.24
Volatile matter	4.49
Fixed carbon	82.20
Ash	13.07
	100.00
Sulphur	0.34

WATER ANALYSES.

With the exceptions of the waters from Montana, the Utah Hot Springs, and the Virginia Hot Springs, the following waters were collected by the Division of the Great Basin, under the direction of Messrs. G. K. Gilbert and I. C. Russell. For sufficient reasons, it was necessary to abbreviate the analyses as much as possible, and this was done by avoiding the direct estimation of carbonic acid. Whenever carbonates were proved to be present all the other ingredients of a water were determined and the carbonic acid, reckoned as CO_3, was taken as the difference between the sum of their weights and the weight of the total solid residue. In computing the probable compounds formed by the union of acids and bases, the chlorides and sulphates were first disposed of, and the bases in excess were then calculated as carbonates. This procedure gave usually a summation a little greater or less than the total solids directly found upon evaporating the water to dryness; and the variation of the result from 100 per cent. afforded a means of estimating the probable accuracy of the analysis. In most cases the samples of water received were insufficient for a search after the less common elements. These, therefore, were necessarily ignored, except in so far as the spectroscope or qualitative tests could reveal their presence. The gaseous contents of the waters received no consideration. In certain respects, therefore, all the analyses are to be regarded as imperfect; although they are fully adequate for the geological purposes which led to their being made.

Each analysis is stated in three columns. First, the actual weight in grammes to the liter of each constituent. Second, the percentage of each relatively to the total solid residue. Third, the probable combination, also in grammes to the liter. The second column gives a means of comparing different waters as to their composition, irrespective of their greater or less salinity. The third column was computed in the simplest terms, and not with reference to complex and doubtful hypotheses.

PYRAMID LAKE, NEVADA.

Four samples of water were analyzed (Clarke), as follows:

A. Water of north end of the lake, near the surface.

B. Water of north end of the lake, depth of 108 meters.

C. Water of south end of the lake, near the surface.

D. Water of south end of the lake, depth of 61 meters.

All four samples contained suspended flakes of silicious and calcareous matter.

A.

[Total solids, 3.4987 grammes to liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0412	1.17	SiO_2	0.0412
SO_4	0.1803	5.15	KCl	0.1474
Cl	1.4298	40.87	NaCl	2.2411
Ca	0.0179	0.51	Na_2SO_4	0.2667
Mg	0.0800	2.29	Na_2CO_3	0.4738
Na	1.1731	33.53	$CaCO_3$	0.0447
K	0.0766	2.19	$MgCO_3$	0.2800
	2.9989			3.4949
CO_3	0.4998	14.29	99.94 per cent. accounted for.	
	3.4987	100.00		

B.

[Total solids: 3.4837 grammes to liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0200	0.57	SiO_2	0.0200
SO_4	0.1850	5.31	KCl	0.1381
Cl	1.4342	41.17	NaCl	2.2550
Ca	0.0179	0.51	Na_2SO_4	0.2737
Mg	0.0805	2.31	Na_2CO_3	0.4756
Na	1.1817	33.92	$CaCO_3$	0.0447
K	0.0723	2.07	$MgCO_3$	0.2818
	2.9916			3.4889
CO_3	0.4921	14.14	Total, 100.15 per cent.	
	3.4837	100.00		

C.

[Total solids: 3.4725 grammes to liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0425	1.22	SiO_2	0.0425
SO_4	0.1772	5.10	KCl	0.1374
Cl	1.4288	41.15	NaCl	2.2466
Ca			Na_2SO_4	0.2621
Mg	0.0752	2.17	Na_2CO_3	0.4940
Na	1.1826	34.06	$CaCO_3$	
K	0.0719	2.07	$MgCO_3$	0.2632
	2.9782			3.4458
CO_3	0.4943	14.23	99.23 per cent. accounted for.	
	3.4725	100.00		

D.

[Total solids: 3.4900 grammes to liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0300	0.86	SiO_2	0.0300
SO_4	0.1864	5.34	KCl	0.1387
Cl	1.4271	40.99	NaCl	2.2428
Ca	....	....	Na_2SO_4	0.2757
Mg	0.0832	2.38	Na_2CO_3	0.4834
Na	1.1809	33.84	$CaCO_3$	....
K	0.0726	2.13	$MgCO_3$	0.2912
	2.9802			3.4618
CO_3	0.5098	14.46	99.19 per cent. accounted for.	
	3.4900	100.00		

The slight differences between these analyses may be attributed in part to the fact that the lake is fed at its southern end by a large stream of fresh water. The four percentage columns may be conveniently compared in the following table:

	A.	B.	C.	D.
Total solids	3.4987	3.4837	3.4725	3.4900
SiO_2	1.17	0.57	1.22	0.86
SO_4	5.15	5.31	5.10	5.34
Cl	40.87	41.17	41.15	40.99
Ca	0.51	0.51	....	....
Mg	2.29	2.31	2.17	2.38
Na	33.53	33.92	34.06	33.84
K	2.19	2.07	2.07	2.13
CO_3	14.29	14.14	14.23	14.46
	100.00	100.00	100.00	100.00

WINNEMUCCA LAKE, NEVADA.

Specific gravity of water, 1.001, at 17°. Analysis by F. W. Clarke.

[Total solids: 3.6025 grammes to liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0275	0.76	SiO_2	0.0275
SO_4	0.1333	3.70	KCl	0.1310
Cl	1.6934	47.01	NaCl	2.6877
Ca	0.0196	0.54	Na_2SO_4	0.1972
Mg	0.0173	0.48	Na_2CO_3	0.4065
Na	1.2970	36.00	$CaCO_3$	0.0254
K	0.0686	1.90	$MgCO_3$	0.0494
	3.2567			3.5247
CO_3	0.3458	9.61	98.44 per cent. accounted for.	
	3.6025	100.00		

WALKER LAKE, NEVADA.

Two analyses (Clarke) were made; one of a sample taken just below the surface, the other of water from a depth of 65.5 meters. Both were collected by Mr. I. C. Russell.

A.—*Surface sample.*

[Total solids: 2.5155 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0075	0.29	SiO_2	0.0075
SO_4	0.5275	20.96	NaCl	0.9681
Cl	0.5875	23.36	Na_2SO_4	0.7803
Ca	0.0267	1.06	Na_2CO_3	0.5157
Mg	0.0391	1.55	$CaCO_3$	0.0667
Na	0.8577	34.11	$MgCO_3$	0.1369
K	trace.			2.4752
	2.0460		98.39 per cent. accounted for.	
CO_3	0.4695	18.67		
	2.5155	100.00		

B.—*Lower sample.*

[Total solids: 2.4875 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0075	.30	SiO_2	0.0075
SO_4	0.5125	20.60	NaCl	0.9558
Cl	0.5800	23.32	Na_2SO_4	0.7580
Ca	0.0176	.71	Na_2CO_3	0.5339
Mg	0.0375	1.51	$CaCO_3$	0.0440
Na	0.8530	34.29	$MgCO_3$	0.1313
K	trace.			2.4305
	2.0081		97.66 per cent. accounted for.	
CO_3	0.4794	19.27		
	2.4875	100.00		

Mud taken from the bottom of the Lake, at a depth of 68 meters, was also examined qualitatively by Dr. Chatard. The portion soluble in water contained chlorides of sodium and potassium, with some sulphates and traces of borates. The residue, extracted with hydrochloric acid, was found to contain carbonates of lime and magnesia, with some phosphates, iron, alumina, and alkalies. The insoluble portion was impure silica.

WALKER RIVER, NEVADA.

The sample of water was collected immediately below the junction or the east and west branches. Analysis by F. W. Clarke.

[Total solids: 0.1800 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0225	12.50	SiO_2	0.0225
SO_4	.0284	15.77	NaCl	0.0216
Cl	.0131	7.28	Na_2SO_4	0.0421
Ca	.0228	12.66	Na_2CO_3	0.0224
Mg	.0038	2.12	$CaCO_3$	0.0570
Na	.0318	17.67	$MgCO_3$	0.0133
	.1224			0.1789
CO_3	.0576	32.00	99.39 per cent. accounted for.	
	.1800	100.00		

HUMBOLDT RIVER, NEVADA.

Sample collected at Stone House. Analysis by T. M. Chatard.

[Total solids: 0.3615 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0326	9.03	SiO_2	.0326
Al_2O_3	.0013	0.37	Al_2O_3	.0013
SO_4	.0477	13.12	KCl	.0157
Cl	.0075	2.08	K_2CO_3	.0046
Ca	.0489	13.53	Na_2CO_3	.0550
Mg	.0124	3.46	Na_2SO_4	.0705
Na	.0467	12.92	$CaCO_3$	.1222
K	.0100	2.77	$MgCO_3$	.0434
	.2071			.3453
CO_3	.1544	42.72	95.52 per cent. accounted for.	
	.3615	100.00		

If the loss in the last column is due to the presence of alkaline bicarbonates, and reckoned in the latter form to make up 100 per cent., we have—

Na_2CO_3	.0200
$NaHCO_3$	.0512

HOT SPRING, WARD'S RANCH, FOOT OF GRANITE MOUNTAIN, NEVADA.

Analysis by T. M. Chatard.

[Total solids: 1.1902 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.1136	9.60	SiO_2, free	0.0180
SO_4	0.3901	32.97	Na_2SiO_3	0.1942
Cl	0.2396	20.25	Na_2SO_4	0.4267
CO_3	trace	....	NaCl	0.3665
Ca	0.0367	3.10	KCl	0.0363
Mg	0.0034	0.29	$CaSO_4$	0.1247
Na	0.3554	30.03	$MgSO_4$	0.0179
K	0.0191	1.61		1.1834
Li	trace			
O for SiO_3	0.0255	2.15	99.43 per cent. accounted for.	
	1.1834	100.00		

HOT SPRING, AT HOT SPRING STATION, NEVADA, C. P. R. R.

Analysis by T. M. Chatard.

[Total solids: 2.4924 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.2788	11.14	SiO_2, free	0.2060
SO_4	0.3555	14.25	Na_2SiO_3	0.1480
Cl	0.9679	38.79	NaCl	1.4946
Ca	0.0305	1.23	Na_2SO_4	0.4039
Mg	0.0010	0.04	KCl	0.1278
Al	0.0010	0.04	$Al_2(SO_4)_3$	0.0063
Na	0.7743	31.04	$MgSO_4$	0.0050
K	0.0669	2.69	$CaSO_4$	0.1037
Li	trace.			2.4953
O in SiO_3	0.0194	.78		
	2.4953	100.00	100.11 per cent. accounted for.	

LARGER SODA LAKE, NEAR RAGTOWN, NEVADA.

Specific gravity of water, 1.101. Two analyses (Chatard) were made, one of a sample taken just below the surface, the other of water from a depth of 30.5 meters.

A.—*Surface sample.*

[Total solids: 125.1300 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.304	0.24	SiO_2	0.304
SO_4	12.960	10.36	KCl	4.820
Cl	45.690	36.51	NaCl	71.470
B_4O_7	0.314	0.25	Na_2SO_4	19.170
Mg	0.270	0.22	Na_2CO_3	26.410
Na	45.840	36.63	$Na_2B_4O_7$	0.404
K	2.520	2.01	$MgCO_3$	0.940
	107.898			123.518
CO_3	17.232	13.78	98.71 per cent. accounted for.	
	125.130	100.00		

If the loss in the last column be reckoned as due to the presence of bicarbonates, it gives, to make up 100 per cent.:

Na_2CO_3	23.640
$NaHCO_3$	4.382

B.—*Lower sample.*

[Total solids: 125.1500 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.310	0.25	SiO_2	0.310
SO_4	13.150	10.50	KCl	5.110
Cl	44.270	35.38	NaCl	68.930
B_4O_7	0.327	0.26	Na_2SO_4	19.450
Mg	0.270	0.21	Na_2CO_3	24.840
Na	44.270	35.38	$Na_2B_4O_7$	0.417
K	2.670	2.13	$MgCO_3$	0.940
	105.267			119.997
CO_3	19.883	15.89	95.88 per cent. accounted for.	
	125.150	100.00		

Reckoning the loss in the last column as in the case of the surface sample, we have—

Na_2CO_3	16.040
$NaHCO_3$	13.953

From the waters of this lake sodium carbonate is manufactured upon a commercial scale. Several brines and products obtained in this manufacture were qualitatively examined by Dr. Chatard. A more complete investigation may be undertaken at some future time. A pale pink-colored brine, from which summer soda had been taken, and in which salt had begun to crystallize, was found to contain carbonates, chlorides, and sulphates of sodium and potassium, with some alkaline phosphates and borates. The pink color was probably due to organic matter. A concentrated brine from the Little Soda Lake contained similar ingredients, minus the phosphates. In a crystalline mass from a vat at the same locality the same constituents were found, with phosphates and a trace of lime. From this vat five annual crops of soda were said to have been taken. The sodium carbonate as it goes to market from the smaller Soda Lake, contains as impurities, sand, clay, considerable chloride, some sulphate, a little borate, a trace of phosphate, and some potassium salts.

MONO LAKE, CALIFORNIA.[7]

A sample of water taken near the surface. Analysis by T. M. Chatard. Specific gravity, 1.045 at 15°.5.

[Total solids: 51.8500 grammes to the liter.][7]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.2800	0.54	SiO	0.2800
SO_4	6.8100	13.11	KCl	2.2300
Cl	12.1300	23.39	NaCl	18.2200
B_4O_7	0.1600	0.34	Na_2SO_4	10.0700
Ca	0.2900	0.55	$Na_2B_4O_7$	0.2000
Mg	0.1300	9.28	Na_2CO_3	19.4900
Na	18.9100	36.46	$CaCO_3$	0.6800
K	1.1600	2.23	$MgCO_3$	0.3600
	39.8700			51.5300
CO_3	11.9800	23.10	99.60 per cent. accounted for.	
	51.8500	100.00		

Mud from the bottom of the lake, taken at a depth of over 30 meters, was also examined qualitatively. The portion soluble in water contained chlorides of potassium and sodium, *no* sulphates, some carbonates, and traces of sulphides. The portion soluble in hydrochloric acid contained iron, alumina, lime, and alkalies, with a little boric acid. The insoluble residue consisted of sand and silica.

[7] A second sample of Mono Lake water, taken from a depth of 30 meters, contained 52.8560 grammes to the liter.

SPRING ON TUFA CRAG, IN MONO LAKE.

Analysis by T. M. Chatard.

[Total solids: 0.2918 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0178	6.10	SiO_2	.0178
SO_4	.0546	18.71	KCl	.0169
Cl	.0144	4.93	NaCl	.0104
Ca	.0414	14.19	Na_2SO_4	.0799
Mg	.0044	1.51	Na_2CO_3	.0506
Na	.0513	17.58	$CaCO_3$	.1035
K	.0088	3.02	$MgCO_3$	.0154
	.1927			.2945
CO_3	.0991	33.96	Total, 100.91 per cent.	
	.2918	100.00		

The water of the "Petroleum Spring," on an island in Mono Lake, yielded a solid residue of 0.8775 gramme to the liter. It contains carbonates, chlorides, and silicates; the bases being sodium, potassium, calcium, magnesium, and aluminum.

WARM SPRING, AT WARM SPRING STATION, MONO BASIN.

Analysis by T. M. Chatard.

[Total solids: 2.0850 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_3	0.1545	7.46	Al_2O_3	0.0018
SO_4	0.3131	15.13	KCl	0.1203
Cl	0.2272	10.98	NaCl	0.2799
Ca	0.0589	2.84	Na_2SO_4	0.4631
Mg	0.0604	2.92	Na_2SiO_3	0.2480
Na	0.6116	29.56	Na_2CO_3	0.5972
K	0.0630	3.05	$CaCO_3$	0.1475
Li	trace.	....	$MgCO_3$	0.2114
Al_2O_3	0.0018	0.09		2.0692
	1.4905		99.24 per cent. accounted for.	
CO_3	0.5945	27.97		
	2.0850	100.00		

BOILING SPRING, FOUR MILES S. E. OF SHAFFER'S RANCH, HONEY LAKE VALLEY, CALIFORNIA.

Analysis by T. M. Chatard.

[Total solids: 1,0218 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.1310	12.83	SiO_2, free	0.1008
SO_4	0.3492	34.19	Na_2SiO_3	0.0613
Cl	0.2070	20.27	Na_2SO_4	0.4715
Ca	0.0121	1.18	NaCl	0.3266
Mg	0.0004	0.04	KCl	0.0180
Na	0.3040	29.78	$CaSO_4$	0.0409
K	0.0094	0.92	$MgSO_4$	0.0020
O for SiO_3	0.0080	0.79		1.0211
	1.0211	100.00	99.93 per cent. accounted for.	

Two other springs in Honey Lake Valley were examined qualitatively. In the water of the High Rock Spring were found carbonates, chlorides, and sulphates of calcium, magnesium, sodium and potassium, with a little silica. The Lower Hot Spring contained chlorides and sulphates of the same bases.

LAKE TAHOE, CALIFORNIA.

Analysis by F. W. Clarke.

[Total solids: 0.0730 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination,	
SiO_2	.0137	18.77	SiO_2	.0137
SO_4	.0054	7.40	KCl	.0034
Cl	.0023	3.14	NaCl	.0012
Ca	.0093	12.74	K_2SO_4	.0034
Mg	.0030	4.11	Na_2SO_2	.0052
Na	.0073	10.00	Na_2CO_3	.0117
K	.0033	4.52	$CaCO_3$	.0233
	.0443		$MgCO_3$	.0105
CO_3	.0287	39.32		.0723
	.0730	100.00	99.04 per cent. accounted for.	

ABERT LAKE, OREGON.

The water of this lake was collected by I. C. Russell, at a point about 150 meters off from the west shore. It was analyzed by Mr. F. W. Taylor, of the Smithsonian Institution, and the analysis is here included merely for the purpose of completing the series of waters specially examined for the division of the Great Basin. Specific gravity, 1.02317.

Contents in one liter.

SiO_2	0.065
NaCl	7,217
KCl	8.455
K_2SO_4	0.921
K_2CO_3	10.691
$MgCO_3$	10.006
	27.355

An efflorescence from the north shore of the lake, examined qualitatively by T. M. Chatard, contained carbonates and chlorides of sodium and potassium, with traces of sulphates, phosphates, and calcium.

UTAH LAKE, UTAH.

Analysis by F. W. Clarke.

[Total solids: 0.3060 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0100	3.27	SiO_2	.0100
SO_4	.1306	42.68	NaCl	.0204
Cl	.0124	4.04	Na_2CO_3	.0204
Ca	.0558	18.24	$CaSO_4$	.1849
Mg	.0186	6.08	$CaCO_3$	.0038
Na	.0178	5.81	$MgCO_3$	.0644
	.2452			.3039
CO_3	.0608	19.88	99.31 per cent accounted for.	
	.3060	100.00		

A little potassium is present, but was not separately estimated.

CITY CREEK, UTAH.

Water collected above the reservoir which supplies Salt Lake City. Analysis by T. M. Chatard.

[Total solids: 0.2400 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination,	
SiO_2	.0090	3.69	SiO_2	.0090
Al_2O_3	.0010	0.41	Al_2O_3	.0010
SO_4	.0070	2.87	NaCl	.0216
Cl	.0131	5.38	Na_2CO_3	.0014
Ca	.0589	24.19	$CaSO_4$	.0099
Mg	.0174	7.15	$CaCO_3$	.1400
Na	.0091	3.74	$MgCO_3$	.0606
	.1155			.2435
CO_3	.1245	52.57	Total, 101.45 per cent.	
	.2400	100.00		

BEAR RIVER, UTAH.

Analysis by F. W. Clarke.

[Total solids: 0.1845 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0070	3.79	SiO_2	.0070
SO_4	.0105	5.69	NaCl	.0081
Cl	0049	2.65	Na_2SO_4	.0155
Ca	.0432	23.41	$CaCO_3$	.1080
Mg	.0125	6.78	$MgCO_3$	.0438
Na	.0082	4.44		.1824
	.0863		98.86 per cent accounted for.	
CO_3	.0982	53.24		
	.1845	100.00		

UTAH HOT SPRINGS, EIGHT MILES N. OF OGDEN, UTAH.

Water received through the Smithsonian Institution. Reported temperature 55°. Analysis by F. W. Clarke.

[Total solids: 23.1150 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0460	0.20	SiO_2	0.0460
Al_2O_3	0.0040	0.02	Al_2O_3	0.0040
SO_4	0.2184	0.94	KCl	1.6732
Cl	13.7030	59.28	NaCl	18.0168
Br	trace.	....	$CaCl_2$	2.9187
CO_3	undet.	....	$MgCl_2$	0.1398
Ca	1.1428	4.83	$CaSO_4$	0.3094
Mg	0.0929	0.40	$MgCO_3$	0.2016
Na	7.0825	30.64		23.3095
K	0.8759	3.79	Total, 100.84 per cent.	
Li	trace.			
	23.1655	100.10		

The CO_3 in the last column, having been proved to be present, was computed to satisfy the excess of magnesium after the other acids had all been balanced. The water as received contained no iron in solution, but held an abundant ferruginous deposit.

LIVINGSTON WARM SPRINGS, MONTANA.

Water received from A. C. Peale. Analysis by F. W. Clarke. Free H_2S present.

[Total solids: 0.7575 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0290	3.83	SiO_2	.0290
SO_4	.2224	29.37	KCl	.0078
Cl	.0124	1.64	NaCl	.0143
Ca	.1678	22.11	Na_2CO_3	.0461
Mg	.0438	5.79	$CaCO_3$	.1880
Na	.0256	3.38	$CaSO_4$	.3150
K	.0041	0.55	$MgCO_3$	.1533
	.5051			.7535
CO_3	.2524	33.33	99.47 per cent. accounted for.	
	.7575	100.00		

WARM SPRINGS OF EMIGRANT GULCH, YELLOWSTONE VALLEY, MONTANA.

Water received from A. C. Peale. Analysis by F. W. Clarke.

[Total solids: 0.2350 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0317	13.49	SiO_2	.0317
SO_4	.0329	14.00	KCl	.0083
Cl	.0074	3.15	NaCl	.0058
Ca	.0346	14.72	Na_2SO_4	.0487
Mg	.0077	3.28	Na_2CO_3	.0274
Na	.0299	12.72	$CaCO_3$	.0865
K	.0043	1.83	$MgCO_3$	.0269
	.1485			.2353
CO_3	.0865	36.81	Total, 100.13 per cent.	
	.2350	100.00		

HELENA HOT SPRINGS, HELENA, MONT.

Water received from A. C. Peale. Reported temperature, 60.5°. Analysis by F. W. Clarke.

[Total solids: 0.6225 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0938	15.06	SiO_2	.0938
SO_4	.1854	29.78	NaCl	.0596
Cl	.0362	5.82	Na_2CO_3	.1730
Ca	.0107	1.72	$CaCO_3$	.0268
Mg	trace.	....	Na_2SO_4	.2742
Na	.1873	30.09		.6274
K	trace.		Total, 100.79 per cent.	
Li	trace.			
	.5134			
CO_3	.1091	17.53		
	.6225	100.00		

MILL CREEK COLD SPRING, YELLOWSTONE VALLEY, MONTANA.

Water received from A. C. Peale. Highly effervescent. Reported temperature, 4.5°. Analysis by F. W. Clarke.

[Total solids: 3.8125 grammes to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	0.0250	0.66	SiO_2	0.0250
$Al_2O_3.Fe_2O_3$	0.0875	2.29	KCl	0.0981
SO_4	0.6500	17.05	NaCl	0.3795
Cl	0.2771	7.27	Na_2SO_4	0.9402
I	trace.	....	Na_2CO_3	0.9853
Ca	0.3768	9.88	$MgCO_3$	0.2838
Mg	0.0811	2.13	$FeCO_3$	0.1268
Na	0.8814	23.12	$CaCO_3$	0.9270
K	0.0513	1.34	$CaSO_4$	0.0204
Li	trace.			3.7861
	2.4302		99.31 per cent. accounted for.	
CO_3	1.3823	36.26		
	3.8125	100.00		

In this analysis the amount of available material was insufficient. The iron in the third column is made to include the trifling quantity of aluminum which, though present, could not be separately estimated; and the calcium sulphate was directly determined as such in the insoluble residue left upon evaporating the water to dryness. The carbonates in the original water are all undoubtedly bicarbonates, and, reckoned as such, should receive the following weights: Sodium bicarbonate, 1.5618; calcium bicarbonate, 1.5017; magnesium bicarbonate, .4932; ferrous bicarbonate, .1945.

VIRGINIA HOT SPRINGS, BATH COUNTY, VIRGINIA.

The waters of six different springs were received from the Virginia Hot Springs Company, as follows:

A. Boiler bath. Temperature, 41° C.

B. Hot spout bath. Temperature, 40°.5 C.

C. Octagon bath. Temperature, 38° C.

D. New hot spring. Temperature, 37° C.

E. "Sulphur" bath. Temperature, 36°.5 C.

F. "Magnesian" spring. Temperature, 25°.5 C.

Analyses by F. W. Clarke. Traces of bromine were found in A and B. The other waters were so similar to these that bromine was not specially sought for in them.

A.—*Boiler bath.*

[Total solids: 0.5975 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0275	4.60	SiO_2	.0275
SO_4	.1319	22.07	Al_2O_3	.0020
Cl	.0050	0.83	KCl	.0105
Al_2O_3	.0020	0.32	K_2SO_4	.0138
Ca	.1356	22.69	Na_2SO_4	.0370
Mg	.0357	5.96	$CaSO_4$	.1407
Na	.0120	2.08	$CaCO_3$	.2355
K	.0117	1.95	$MgCO_3$	.1249
	.3614			.5919
CO_3	.2361	39.50	99.06 per cent. accounted for.	
	.5975	100.00		

B.—*Hot spout bath.*

[Total solids: 0.5925 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0235	3.97	SiO_2	.0235
SO_4	.1298	21.91	Al_2O_3	.0025
Cl	.0044	0.74	KCl	.0092
Al_2O_3	.0025	0.42	K_2SO_4	.0187
Ca	.1375	23.21	Na_2SO_4	.0281
Mg	.0343	5.79	$CaSO_4$	.1424
Na	.0091	1.53	$CaCO_3$	.2390
K	.0132	2.23	$MgCO_3$	.1201
	.3543			.5835
CO_3	.2382	40.20	98.46 per cent. accounted for.	
	.5925	100.00		

C.—*Octagon bath.*

[Total solids: 0.5940 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0255	4.29	SiO_2	.0255
SO_4	.1364	22.96	Al_2O_3	.0035
Cl	.0041	0.69	KCl	.0086
Al_2O_3	.0035	0.59	K_2SO_4	.0185
Ca	.1378	23.20	Na_2SO_4	.0296
Mg	.0348	5.86	$CaSO_4$	.1504
Na	.0096	1.61	$CaCO_3$	.2340
K	.0128	2.15	$MgCO_3$	.1218
	.3645			.5919
CO_3	.2295	38.65	99.64 per cent. accounted for.	
	.5940	100.00		

D.—*New hot spring.*

[Total solids: 0.5740 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0235	4.09	SiO_2	.0235
SO_4	.1294	22.54	Al_2O_3	.0060
Cl	.0029	0.50	KCl	.0061
Al_2O_3	.0060	1.04	K_2SO_4	.0212
Ca	.1329	23.15	Na_2SO_4	.0278
Mg	.0351	6.13	$CaSO_4$	.1401
Na	.0090	1.57	$CaCO_3$	.2272
K	.0127	2.21	$MgCO_3$	.1228
	.3515			.5747
CO_3	.2225	38.77	Total, 100.12 per cent.	
	.5740	100.00		

E.—"*Sulphur*" *bath.*

[Total solids: 0.5775 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0230	3.98	SiO_2	.0230
SO_4	.1273	22.04	Al_2O_3	.0065
Cl	.0032	0.55	KCl	.0068
Al_2O_3	.0065	1.13	K_2SO_4	.0158
Ca	.1318	22.82	Na_2SO_4	.0420
Mg	.0330	5.71	$CaSO_4$	.1278
Na	.0136	2.36	$CaCO_3$	.2355
K	.0107	1.85	$MgCO_3$	.1155
	.3491			.5729
CO_3	.2284	39.56	99.20 per cent. accounted for.	
	.5775	100.00		

No H_2S nor sulphides were found in this water. The spring, however, is said to have at times a "sulphur odor."

F.—*Magnesian spring.*

[Total solids; 0.3825 gramme to the liter.]

Found.		Per cent. of total solids.	Probable combination.	
SiO_2	.0120	3.14	$Si\ O_2$	.0120
O_4	.0721	18.85	KCl	.0042
Cl	.0020	0.52	K_2SO_4	.0109
Ca	.0957	25.02	Na_2SO_4	.0201
Mg	.0209	5.46	$CaSO_4$	.0744
Na	.0065	1.70	$CaCO_3$	.1845
K	.0071	1.85	$MgCO_3$	.0731
	.2163			.3792
CO_3	.1662	43.46	99.14 per cent. accounted for.	
	.3825	100.00		

Why this spring is specially named "Magnesian" is not explained. It will be noted that this spring, the coolest of the series, is proportionally richer in carbonates and poorer in sulphates than the others. This relation is shown by a comparison of the percentage columns.

THE ESTIMATION OF ALKALIES IN SILICATES, BY THOMAS M. CHATARD.

Walter Hempel proposed (Fres. Zschr. 1881, p. 496) bismuth subnitrate as a means of decomposing silicates containing alkalies, and recommended the use of 20 parts of this salt (=10 parts of bismuth oxide) to one part of the silicate. In the Berichte d. D. Chem. Gesellsch, 1881, there is an abstract of his paper, in which is proposed the use of bismuth oxide directly.

This process has been in use in this laboratory for the past six months, and, with some modifications, has given great satisfaction. Bismuth oxide has been used instead of the subnitrate, and experience has shown that, instead of ten parts, as stated above, *two parts* of oxide to *one part* of the mineral are ample in every case in which we have employed the method.

The oxide and mineral, both finely powdered, must be most thoroughly mixed, and then heated in a platinum crucible; applying at first a gentle heat and gradually increasing to full redness, which is kept up ten to fifteen minutes. In the case of an acid silicate, complete fusion may result, while the more basic the silicate the less fusible the mixture will be. Complete decomposition has been obtained when the resulting mass was so slightly sintered together as to fall on gentle pressure into powder, none of which adhered to the crucible. It has therefore been found advantageous, in dealing with acid silicates, to add to the mixture a quantity of calcium carbonate, in weight equal to that of the mineral. This device prevents the fusion which might hinder the after treatment with acid.

After the mass has been thoroughly heated to bright redness it is allowed to cool, placed in a dish, and hydrochloric acid somewhat diluted poured over it. On heating over the water bath the mass should go into solution rapidly, leaving no residue of undecomposed mineral, which is easily distinguishble from floating flakes of silica.

If complete analysis is required, evaporate to dryness and separate the silica, as in a soda fusion, afterwards removing the bismuth by sulphureted hydrogen. If only alkalies are to be determined, add ammonia and ammonium carbonate, filter, and separate magnesia from the alkalies by any of the usual methods.

The results of this process have been very satisfactory. Out of a large number of analyses the following duplicate has been selected as being sufficient to show the accuracy of the work. It may be remarked that in the case of this margarite (a very basic silicate) the mass was but slightly sintered together.

Margarite.—Gainesville, Ga.

1.0300 grammes gave 0.0440 alkali chlorides = 0.0233 Na_2O = 2.26 per cent.
1.0243 grammes gave 0.0435 alkali chlorides = 0.0231 Na_2O = 2.25 per cent.

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