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UNITED STATES DEPARTMENT OF THE INTERIOR

ANALYSES OF ROCKS AND MINERALS

FROM THE  
LABORATORY OF THE UNITED STATES  
GEOLOGICAL SURVEY

1914-36

GEOLOGICAL SURVEY BULLETIN 878



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UNITED STATES DEPARTMENT OF THE INTERIOR  
Harold L. Ickes, Secretary  
GEOLOGICAL SURVEY  
W. C. Mendenhall, Director

Bulletin 878

# ANALYSES OF ROCKS AND MINERALS

FROM THE

LABORATORY OF THE UNITED STATES  
GEOLOGICAL SURVEY

1914-36

TABULATED BY  
ROGER C. WELLS  
*Chief Chemist*



*Bibl. Kat. Nauk o Ziemi  
Dzieln. 8.*

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REPORT ON THE FIRST SERIES  
GEOLOGICAL SURVEY  
1911



1937-265



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# ANALYSES OF ROCKS AND MINERALS FROM THE LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY, 1914-36

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Tabulated by ROGER C. WELLS

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## INTRODUCTION

This bulletin is a supplement to Bulletin 591. Although that bulletin included all the material in several earlier publications, thus being complete from 1880 to 1914, it was already so large that an attempt to incorporate it with newer material appeared unwise. Anyone wishing to make an exhaustive search for analyses will therefore have to consult both bulletins. Although many of the analyses here given have already been published and others are still in manuscript form, a considerable number are not on record elsewhere. Moreover, as the figures that have been published are widely scattered in different scientific journals and Government publications, it is impossible to find them without a great expenditure of time. Here the rock analyses are tabulated by locality and the minerals by name, and record numbers are given so that even the projects involved can be located.

The present United States Geological Survey was organized in 1879. In 1880, in connection with the Colorado work, a chemical laboratory was established at Denver in charge of W. F. Hillebrand, with whom were associated Antony Guyard and, later, L. G. Eakins. In 1882 W. H. Melville was placed in charge of a second laboratory at San Francisco, and in the autumn of 1883 a central laboratory was started in Washington, with F. W. Clarke as chief chemist. In 1885 Dr. Hillebrand was transferred to Washington, followed by Mr. Eakins in 1888, and the Denver laboratory was discontinued. In the spring of 1890 Dr. Melville also was transferred to Washington, and since then the geochemical work of the Survey has been concentrated at headquarters. The laboratory was in charge of George Steiger from 1917 until my appointment in 1930.

The special laboratories of the water-resources and technologic branches of the Geological Survey are not included in this statement, and their work is not represented in this bulletin, nor are the large



number of determinations of potash in drill cores and cuttings made in connection with the Government's search for potash, which constituted in effect a special line of investigation for many years, especially from 1926 to 1931. Determinations of phosphate, assays for gold and silver, tests of clays, and similar routine tests are also omitted.

Analyses of rocks and minerals made in the laboratory at Washington up to January 1, 1914, are tabulated in Bulletin 591. Water analyses are given in many water-supply papers, indexed in Water-Supply Papers 560-C and 659-C. Since Bulletin 591 was published 1,533 more rocks and minerals have been analyzed, and considerable research work on mineralogic and geochemical problems has been done. In this work the following chemists have been engaged: G. R. Backus, R. K. Bailey, G. V. Brown, A. A. Chambers, E. T. Erickson, J. G. Fairchild, J. J. Fahey, E. P. Henderson, W. B. Hicks, R. M. Kamm, Charles Milton, Chase Palmer, L. T. Richardson, B. Salkover, W. T. Schaller, George Steiger, R. E. Stevens, R. C. Wells, and W. C. Wheeler. At present (Jan. 1, 1936) nine of these chemists are employed. Other members of the Survey have been occupied more or less with chemical questions, but the men named in this list were connected directly with the laboratory.

It may be interesting to compare the number of analyses made in the Survey laboratory since 1914 with those previously made, as follows:

	1880-1914	1914-36
Igneous and crystalline rocks.....	1,407	444
Sandstones, cherts, and sinters.....	79	64
Carbonate rocks.....	315	215
Slates and shales.....	65	24
Clays, soils, etc.....	147	115
Ores and gangue material.....		156
Meteorites.....	62	None
Minerals.....	714	515
Total.....	2,789	1,533

This makes a total of 4,322 quantitative analyses made since the organization of the laboratory, not including a vast number of partial routine determinations and numerous analyses made in connection with research problems and the development of methods.

The object here is mainly to put on record the additional analyses made since 1914. Other publications, chiefly by Clarke and Washington, deal fully with the classification of rocks, the average composition of different kinds of rocks and of the earth's crust, and the distribution and abundance of the elements.<sup>1</sup> A recalculation of

<sup>1</sup> See U. S. Geol. Survey Prof. Papers 14, 18, 28, 99, 127, and 132-D; Bulls. 148, 168, 176, 228, 305, 330, 419, 422, 491, 591, 616, 695, 700, and 770.



these figures to include later analyses would require much labor and probably introduce but few significant changes. Several chemists in this and other countries, however, have recently studied in more detail the distribution of certain ore-forming and rare elements.

#### THE ELEMENTS AND THEIR RELATIVE ABUNDANCE

Spectroscopic studies have shown a wide distribution of tin and germanium, previously unsuspected. Hafnium has been found in zirconium minerals, and columbium and tantalum in titanium minerals. Fluorine and selenium have been found in many surface waters, and many minor constituents have been determined in certain ores and rare minerals. The determination of such minor constituents has generally been accomplished by physical methods rather than by chemical separations. It results from the very meager knowledge of the proportion of rare minerals in the earth's crust that estimates of the distribution of the elements by different investigators differ widely, sometimes by several decimal places. Contributions to the knowledge of the subject have been made especially by Goldschmidt,<sup>2</sup> the Noddacks,<sup>3</sup> Schneiderhöhn,<sup>4</sup> and Fersman.<sup>5</sup> Fersman gives an excellent bibliography of the subject. He has also proposed the term "clarke" to designate a unit for indicating the relative abundance of an element either by weight or by number of atoms in any particular kind of rock or in the earth's crust, in honor of F. W. Clarke, who did so much for geochemical statistics. As Fersman's study of 1932 assembles figures for the abundance of all the elements based on all preceding work, it seems advisable to give his results, which are shown in the sixth and seventh columns of the following table. The sixth column gives percentages by weight, the seventh column percentages by atoms for the relative abundance of each element in the 10-mile crust of the earth, based on the estimates of Clarke, Washington, Goldschmidt, Vogt, Niggli, Noddack, Vernadski, Hevesy, Paneth, and others.

The table also gives the atomic number of each element, the latest figure for its atomic weight, and the number of its isotopes, if this has been determined. Schneiderhöhn's figures for the relative abundance of certain elements (1934) differ considerably from those of Fersman, but, as previously remarked, such differences seem unavoidable in the present very scanty knowledge of the subject.

<sup>2</sup> Goldschmidt, V. M., *Geochemische Verteilungsgesetze und kosmische Häufigkeit der Elemente: Die Naturwissenschaften*, Band 18, pp. 999-1013, 1930.

<sup>3</sup> Noddack, Ida and Walter, *Die Häufigkeit der chemischen Elemente: Die Naturwissenschaften*, Band 18, p. 757, 1930.

<sup>4</sup> Schneiderhöhn, H., *Die Ausnutzungsmöglichkeiten der deutschen Erzlagerstätten: Metallwirtschaft*, Band 13, pp. 151-157, 1934.

<sup>5</sup> Fersman, A. E., *Geochemistry*, Leningrad, 1933.



*The elements and their relative abundance*

Element	Symbol	Atomic number	Atomic weight	Number of isotopes	Abundance	
					Percent by weight	Percent by atoms
Actinium	Ac	89	227			
Alabama	Ab	85				
Aluminum	Al	13	26.97	1	7.45	4.80
Antimony	Sb	51	121.76	2	$5 \times 10^{-3}$	$7 \times 10^{-3}$
Argon	A	18	39.944	2	$4 \times 10^{-4}$	$1.7 \times 10^{-4}$
Arsenic	As	33	74.91	1	$5 \times 10^{-4}$	$1 \times 10^{-4}$
Barium	Ba	56	137.36	4	0.05	$6 \times 10^{-3}$
Beryllium	Be	4	9.02	3	0.003	$6 \times 10^{-3}$
Bismuth	Bi	83	209.00	14	$1 \times 10^{-5}$	$8 \times 10^{-7}$
Boron	B	5	10.82	2	0.01	0.015
Bromine	Br	35	79.916	2	0.001	$2 \times 10^{-4}$
Cadmium	Cd	48	112.41	6	$5 \times 10^{-4}$	$8 \times 10^{-3}$
Calcium	Ca	20	40.08	3	3.25	1.41
Carbon	C	6	12.00	3	0.35	0.51
Cerium	Ce	58	140.13	2	$2.9 \times 10^{-3}$	$4 \times 10^{-4}$
Cesium	Cs	55	132.91	1	$5 \times 10^{-4}$	$7 \times 10^{-3}$
Chlorine	Cl	17	35.457	3	0.20	0.10
Chromium	Cr	24	52.01	4	0.03	$9 \times 10^{-3}$
Cobalt	Co	27	58.94	1	0.002	$9 \times 10^{-4}$
Columbium	Cb	41	92.91	3	$3.2 \times 10^{-3}$	$6 \times 10^{-6}$
Copper	Cu	29	63.57	2	0.01	$3 \times 10^{-3}$
Dysprosium	Dy	66	162.46	7	$7.5 \times 10^{-4}$	$8 \times 10^{-3}$
Erbium	Er	68	167.64	2	$6.5 \times 10^{-4}$	$7 \times 10^{-3}$
Europium	Eu	63	152.0	3	$2 \times 10^{-3}$	$3 \times 10^{-3}$
Fluorine	F	9	19.00	1	0.08	0.07
Gadolinium	Gd	64	157.3	7	$7.5 \times 10^{-4}$	$8 \times 10^{-3}$
Gallium	Ga	31	69.72	2	$1 \times 10^{-3}$	$2.5 \times 10^{-4}$
Germanium	Ge	32	72.60	8	$1 \times 10^{-4}$	$2.5 \times 10^{-3}$
Gold	Au	79	197.2	5	$5 \times 10^{-4}$	$4 \times 10^{-7}$
Hafnium	Hf	72	178.6	4	$4 \times 10^{-4}$	$4 \times 10^{-3}$
Helium	He	2	4.002	2	$1 \times 10^{-6}$	$4 \times 10^{-6}$
Holmium	Ho	67	163.5	4	$1 \times 10^{-4}$	$1 \times 10^{-3}$
Hydrogen	H	1	1.0078	3	1.00	17.25
Illium	Il	61				
Indium	In	49	114.76	1	$1 \times 10^{-3}$	$1.5 \times 10^{-6}$
Iodine	I	53	126.92	1	$1 \times 10^{-4}$	$1.5 \times 10^{-3}$
Iridium	Ir	77	193.1	1	$1 \times 10^{-6}$	$1 \times 10^{-7}$
Iron	Fe	26	55.84	2	4.20	1.31
Krypton	Kr	36	83.7	6	$2 \times 10^{-5}$	$4 \times 10^{-9}$
Lanthanum	La	57	138.92	1	$6.5 \times 10^{-4}$	$8 \times 10^{-3}$
Lead	Pb	82	207.22	16	$1.6 \times 10^{-3}$	$1 \times 10^{-4}$
Lithium	Li	3	6.940	2	0.005	0.012
Lutecium	Lu	71	175.0	7	$1.75 \times 10^{-4}$	$1.7 \times 10^{-3}$
Magnesium	Mg	12	24.32	3	2.35	1.72
Manganese	Mn	25	54.93	1	0.10	0.03
Masurium	Ma	43	96	1	$1 \times 10^{-7}$	$1.5 \times 10^{-3}$
Mercury	Hg	80	200.61	9	$1 \times 10^{-4}$	$7 \times 10^{-6}$
Molybdenum	Mo	42	96.0	7	$1 \times 10^{-3}$	$2 \times 10^{-4}$
Neodymium	Nd	60	144.27	4	$1.75 \times 10^{-3}$	$2 \times 10^{-4}$
Neon	Ne	10	20.183	4	$5 \times 10^{-7}$	$4 \times 10^{-7}$
Nickel	Ni	28	58.69	3	0.02	$6 \times 10^{-3}$
Nitrogen	N	7	14.008	2	0.04	0.05
Osmium	Os	76	191.5	6	$5 \times 10^{-6}$	$5 \times 10^{-7}$
Oxygen	O	8	16.0000	3	49.13	53.30
Palladium	Pd	46	106.7	1	$8 \times 10^{-6}$	$1.5 \times 10^{-6}$
Phosphorus	P	15	31.02	1	0.12	0.07
Platinum	Pt	78	195.23	7	$5 \times 10^{-6}$	$4 \times 10^{-7}$
Polonium	Po	84	210	1	$5 \times 10^{-6}$	$4 \times 10^{-7}$
Potassium	K	19	39.096	5	2.35	1.05
Protactinium	Pa	91	231	1	$7 \times 10^{-11}$	$5 \times 10^{-12}$
Praseodymium	Pr	59	140.92	1	$4.5 \times 10^{-4}$	$6 \times 10^{-3}$
Radium	Ra	88	226.05	4	$3 \times 10^{-10}$	$2.0 \times 10^{-11}$
Radon	Rn	86	222	3	$1.2 \times 10^{-15}$	$1 \times 10^{-19}$
Rhenium	Re	75	186.31	2	$1 \times 10^{-7}$	$1 \times 10^{-3}$
Rhodium	Rh	45	102.91	7	$1 \times 10^{-6}$	$1.5 \times 10^{-7}$
Rubidium	Rb	37	85.44	2	0.008	$2 \times 10^{-3}$
Ruthenium	Ru	44	101.7	7	$5 \times 10^{-6}$	$1 \times 10^{-6}$
Samarium	Sm	62	150.43	7	$7 \times 10^{-4}$	$8 \times 10^{-3}$
Scandium	Sc	21	45.10	1	$6 \times 10^{-4}$	$2.5 \times 10^{-4}$
Selenium	Se	34	78.96	8	$8 \times 10^{-5}$	$1.5 \times 10^{-3}$
Silicon	Si	14	28.06	3	26.00	16.10
Silver	Ag	47	107.880	2	$1 \times 10^{-3}$	$1.5 \times 10^{-6}$
Sodium	Na	11	22.997	4	2.40	1.82
Strontium	Sr	38	87.63	3	0.035	$7 \times 10^{-3}$
Sulphur	S	16	32.06	5	0.10	0.05
Tantalum	Ta	73	180.88	7	$2.4 \times 10^{-3}$	$2.3 \times 10^{-6}$
Tellurium	Te	52	127.61	8	$1 \times 10^{-6}$	$1.5 \times 10^{-7}$
Terbium	Tb	65	159.2	7	$1 \times 10^{-4}$	$1 \times 10^{-3}$



*The elements and their relative abundance—Continued*

Element	Symbol	Atomic number	Atomic weight	Number of isotopes	Abundance	
					Percent by weight	Percent by atoms
Thallium.....	Tl	81	204.39	8	$1 \times 10^{-5}$	$8 \times 10^{-7}$
Thorium.....	Th	90	232.12	8	$2 \times 10^{-3}$	$1 \times 10^{-4}$
Thulium.....	Tm	69	169.4	-----	$1 \times 10^{-4}$	$1 \times 10^{-5}$
Tin.....	Sn	50	118.70	11	$6 \times 10^{-4}$	$8 \times 10^{-5}$
Titanium.....	Ti	22	47.90	2	0.61	0.22
Tungsten.....	W	74	184.0	4	$9 \times 10^{-4}$	$9 \times 10^{-5}$
Uranium.....	U	92	238.14	8	$9 \times 10^{-4}$	$4 \times 10^{-5}$
Vanadium.....	V	23	50.95	1	0.02	$7 \times 10^{-3}$
Virginium.....	Vi	87	-----	-----	-----	-----
Xenon.....	Xe	54	131.3	9	$3 \times 10^{-3}$	$4 \times 10^{-10}$
Ytterbium.....	Yb	70	173.04	-----	$8 \times 10^{-4}$	$8 \times 10^{-5}$
Yttrium.....	Y	39	88.92	3	0.005	$1 \times 10^{-3}$
Zinc.....	Zn	30	65.38	7	0.02	$5 \times 10^{-3}$
Zirconium.....	Zr	40	91.22	4	0.025	$5 \times 10^{-3}$

## ABBREVIATIONS USED

Of the abbreviations used for bibliographic reference only five need explanation, and they refer to the official publications of the Survey—"Ann." for Annual Report, "Mon." for Monograph, "Bull." for Bulletin, "Prof. Paper" for Professional Paper, and "Folio" for Folio of the Geologic Atlas. The others relate to well-known journals and are familiar to all geologists. In the tables of analyses the symbols  $H_2O-$  and  $H_2O+$  indicate, respectively, the water lost at or near  $105^\circ$  and that expelled at higher temperatures.

For the information of readers in foreign countries the abbreviations used for names of States of the United States are explained below:

Ala., Alabama.	La., Louisiana.	N. Dak., North Dakota.
Ariz., Arizona.	Md., Maryland.	Okla., Oklahoma.
Ark., Arkansas.	Mass., Massachusetts.	Oreg., Oregon.
Calif., California.	Mich., Michigan.	Pa., Pennsylvania.
Colo., Colorado.	Minn., Minnesota.	R. I., Rhode Island.
Conn., Connecticut.	Miss., Mississippi.	S. C., South Carolina.
Del., Delaware.	Mo., Missouri.	S. Dak., South Dakota.
D. C., District of Columbia.	Mont., Montana.	Tenn., Tennessee.
Fla., Florida.	Nebr., Nebraska.	Tex., Texas.
Ga., Georgia.	Nev., Nevada.	Vt., Vermont.
Ill., Illinois.	N. H., New Hampshire.	Va., Virginia.
Ind., Indiana.	N. J., New Jersey.	Wash., Washington.
Kans., Kansas.	N. Mex., New Mexico.	W. Va., West Virginia.
Ky., Kentucky.	N. Y., New York.	Wis., Wisconsin.
	N. C., North Carolina.	Wyo., Wyoming.

## CLASSIFICATION

The classifications used in this bulletin are essentially similar to those used by F. W. Clarke in Bulletin 591. However, I am indebted to T. W. Stanton, formerly chief geologist, for suggesting the addition of the class "Ores and gangue material" for substances that fall



better under that head than under any of the others. I am also indebted to many other members of the Survey for suggestions and assistance in naming the specimens analyzed, particularly to C. S. Ross in connection with the igneous rocks and clay<sup>1</sup> minerals and for critically reading the whole manuscript, and to W. T. Schaller for mineralogic criticism. Opinions will naturally differ somewhat as to the exact classification of many of the substances whose analyses are given in the following pages, depending on the purpose for which the analyses were made or the viewpoint of the reader. The arrangement has been adopted for convenience; consequently, for example, a substance like vanoxite is listed as an oxide rather than a vanadate, and the garnets are all listed under the group name. Undetermined or impure clays will be found under the heading "Clays", whereas well-identified species will be found under "Minerals." Samples representing material in the mass are classified mainly as rocks, pure single specimens as minerals, and materials containing common metals of commercial interest generally as ores.

## ANALYSES OF IGNEOUS AND CRYSTALLINE ROCKS

### ALASKA

#### CENTRAL ALASKA

Samples of granodiorite rocks collected by J. B. Mertie, Jr. Analysis A by Charles Milton, B-F by J. G. Fairchild, record D-117.

A. Composite sample of four specimens from Roughtop (Moose) Mountain, 14 miles N. 20° W. from Hot Springs.

B. Composite sample of four specimens from Elephant Mountain, 26 miles N. 41° E. from Hot Springs.

C. From Wolverine Mountain, 15 miles S. 35° E. from Rampart.

D. From mountain 17 miles S. 41° E. from Rampart.

E. Specimen from Sawtooth (Lynx) Mountain, 21 miles S. 68° E. from Rampart.

F. Composite sample of five specimens, Hot Springs Dome, 3 miles northwest of Hot Springs.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	54.20	56.89	67.44	64.52	53.11	73.92
Al <sub>2</sub> O <sub>3</sub> .....	18.43	14.59	15.45	14.90	16.45	13.46
Fe <sub>2</sub> O <sub>3</sub> .....	.55	.45	.65	.42	.76	.94
FeO.....	6.38	6.13	2.68	3.72	8.29	1.26
MgO.....	3.08	4.23	.88	1.85	3.28	.53
CaO.....	7.20	6.10	2.38	3.52	5.65	1.11
Na <sub>2</sub> O.....	2.64	2.10	3.26	2.62	2.02	2.42
K <sub>2</sub> O.....	5.31	6.32	5.97	5.98	6.38	5.18
H <sub>2</sub> O.....	.05	.14	.06	.09	.20	.20
H <sub>2</sub> O+.....	.28	.74	.51	.76	1.15	.36
TiO <sub>2</sub> .....	.81	1.00	.41	.45	1.40	.35
CO <sub>2</sub> .....	.23	.55	.32	.71	.95	.15
P <sub>2</sub> O <sub>5</sub> .....	.60	.40	.16	.20	.55	.10
MnO.....	.12	.11	.03	.09	.08	.04
Total.....	99.88	99.75	100.20	99.83	100.27	100.02

Four granitic rocks collected from central Alaska by Mertie and analyzed by E. T. Erickson, record D-415.

G. Summit of ridge at head of Monument and Flint Creeks, in the Ruby district, 7 miles S. 20° E. of Long.

H. Southeast side of Mammoth Creek, opposite mouth of Miller Creek, 38 miles S. 38° W. of Circle.



I. Head of Hidden Creek, in the Nixon Fork district, 32 miles N. 57° E. of McGrath.

J. Composite sample from head of Flat Creek, in the Iditarod district, 3½ miles due south of Flat.

	G	H	I	J		G	H	I	J
SiO <sub>2</sub> .....	74.02	75.98	64.84	57.16	H <sub>2</sub> O-.....	0.09	0.05	0.04	0.04
Al <sub>2</sub> O <sub>3</sub> .....	12.02	11.70	15.20	16.88	H <sub>2</sub> O+.....	.28	.42	.41	.69
Fe <sub>2</sub> O <sub>3</sub> .....	.92	.39	.73	.26	TiO <sub>2</sub> .....	.26	.22	.30	.30
FeO.....	2.72	2.24	4.18	5.36	CO <sub>2</sub> .....	.04	Trace	.48	.11
MgO.....	.69	.30	2.02	4.78	P <sub>2</sub> O <sub>5</sub> .....				
CaO.....	1.46	.58	3.04	4.08	MnO.....	.05	None	.06	.08
Na <sub>2</sub> O.....	3.22	2.73	4.03	4.67					
K <sub>2</sub> O.....	4.28	5.46	4.55	5.32		100.05	100.07	99.88	99.73

SOUTHEASTERN ALASKA

Rocks collected by A. F. Buddington. Analyses by J. G. Fairchild, record C-858. Described by Buddington and Chapin in Bull. 800, 1929.

A. Quartz monzonite, average of 6 samples from the Hyder district.

B. Granodiorite, average of 6 samples from the Hyder district.

C. Quartz diorite, average of 14 samples from the western border of the Coast Range batholith.

D. Diorite, Etolin Island.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	70.86	64.87	59.55	50.24	K <sub>2</sub> O.....	4.60	3.30	2.62	1.40
Al <sub>2</sub> O <sub>3</sub> .....	14.96	16.26	16.18	17.86	H <sub>2</sub> O-.....	None	None	.04	.03
Fe <sub>2</sub> O <sub>3</sub> .....	1.06	1.51	1.94	2.00	H <sub>2</sub> O+.....	.40	.28	.82	1.39
FeO.....	1.43	2.89	5.61	6.56	TiO <sub>2</sub> .....	.34	.70	.96	1.32
MgO.....	.41	1.72	2.86	5.47	P <sub>2</sub> O <sub>5</sub> .....	.11	.19	.26	.24
CaO.....	2.23	4.72	6.26	10.50					
Na <sub>2</sub> O.....	3.90	3.82	3.40	3.51		100.30	100.26	100.50	100.61

Eocene lavas from southeastern Alaska, collected by A. F. Buddington and described in Am. Jour. Sci., 5th ser., vol. 23, pp. 490-496, 1932. Analyses E, F by R. C. Wells, C-M by J. G. Fairchild, records D-18 and D-41.

	E	F	G	H	I	J	K	L	M
SiO <sub>2</sub> .....	52.05	53.40	51.45	48.66	72.62	75.47	76.18	67.01	57.70
Al <sub>2</sub> O <sub>3</sub> .....	15.03	13.35	16.30	13.40	10.17	9.39	12.95	13.94	16.28
Fe <sub>2</sub> O <sub>3</sub> .....	2.78	2.58	2.43	1.29	4.60	1.21	None?	1.00	2.88
FeO.....	5.54	11.25	7.20	11.58	1.88	3.31	2.05	3.47	6.00
MgO.....	4.94	2.33	3.16	8.72	.10	.10	Trace?	.45	1.55
CaO.....	9.27	6.58	7.45	8.92	.10	.10	.05	1.90	5.30
Na <sub>2</sub> O.....	2.33	3.80	2.77	3.34	4.53	2.49	3.33	5.63	4.90
K <sub>2</sub> O.....	1.01	1.36	2.33	.80	4.78	4.46	4.59	2.92	.89
H <sub>2</sub> O.....	1.18	.68	.50	.10	.08	.03	.02	.32	.45
H <sub>2</sub> O+.....	2.66	1.50	2.52	.17	.37	1.21	.85	2.51	1.35
TiO <sub>2</sub> .....	1.42	2.03	2.38	2.77	.35	.65	.15	.40	.91
CO <sub>2</sub> .....	1.86	.61	.66	None	Trace	Trace	Trace	.65	1.08
P <sub>2</sub> O <sub>5</sub> .....	.28	.75	.35	.35	Trace	.05	Trace	.08	.56
F.....	.06	None	.05	.05				.08	.02
S.....	None	.07	.02	Trace?	Trace?		.03		
SO <sub>2</sub> .....						.10		.07	.04
V <sub>2</sub> O <sub>5</sub> .....	.02	Trace	.03	.03	None	None	None		
MnO.....	.07	.13	.12	.12	Trace?	None	None	.08	.16
BaO.....	.05	.06	None	None	None	None	None	.09	.07
SrO.....	Trace	None	None	None	None	None	None	None	.02
ZrO <sub>2</sub> .....	.02	Trace							
FeS <sub>2</sub> .....			None	None	None	.97	None		
Cr <sub>2</sub> O <sub>3</sub> .....	.03	None							
Less O.....	100.60	100.48	99.72	100.30	99.58	99.54	100.20	100.60	100.16
	.03	.04	.02	.02				.03	.01
	100.57	100.44	99.70	100.28				100.57	100.15



## ARIZONA

## AJO DISTRICT

Six rocks collected by James Gilluly. Analyses by J. G. Fairchild, record D-281.

A. Micaceous quartz diorite, 700 feet southwest of mine office, Ajo copper mine. Quartz, andesine-oligoclase, biotite, chlorite, epidote, apatite, magnetite, sericite.

B. Quartz monzonite. East spur of hill south of manager's residence, Ajo mine. Quartz, albite, orthoclase(?), chlorite, muscovite, clay(?), barite(?), titanite, ilmenite, zircon.

C. Hornblende-biotite-quartz monzonite, almost fresh, 600 feet south of east crest of Camelback Mountain, southwest of Ajo. Oligoclase-andesine, orthoclase, quartz, hornblende, biotite, chlorite, sericite, epidote, apatite, titanite, magnetite.

D. Albitized quartz diorite, west side of approach cut to Ajo copper mine, 1,000 feet south of drill-sharpening house. Albite, sericite, epidote, quartz, chlorite, magnetite, apatite.

E. Albitized sericitic quartz monzonite, southwest side of mine pit, due east of crest of Arkansas Mountain. Albite, sericite, orthoclase, quartz, chlorite, apatite, epidote, titanite(?), calcite.

F. Quartz monzonite, 2,890-foot peak west of Gibson Gulch, about 2 miles west of Ajo. Oligoclase-andesine, orthoclase, quartz, hornblende, biotite, chlorite, sericite, epidote, apatite, magnetite, zircon, titanite.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	60.59	66.92	66.23	62.27	65.66	65.29
Al <sub>2</sub> O <sub>3</sub> .....	17.39	15.78	15.71	17.40	15.98	15.74
Fe <sub>2</sub> O <sub>3</sub> .....	1.60	1.30	2.20	2.35	1.45	2.05
FeO.....	1.98	1.08	1.98	2.79	2.70	2.03
MgO.....	2.38	1.40	1.58	2.86	2.14	1.84
CaO.....	5.06	.76	3.78	1.19	1.88	3.66
Na <sub>2</sub> O.....	4.09	3.46	3.89	4.10	3.55	3.77
K <sub>2</sub> O.....	1.63	5.26	3.22	2.76	3.70	4.11
H <sub>2</sub> O.....	.78	.71	.03	.50	.20	.14
H <sub>2</sub> O+.....	3.29	1.92	.67	2.65	1.52	.62
TiO <sub>2</sub> .....	.61	.56	.47	.84	.60	.54
P <sub>2</sub> O <sub>5</sub> .....	.36	.28	.24	.30	.31	.24
MnO.....	.08	.05	.08	.05	.02	.07
CO <sub>2</sub> .....					.47	
F.....		.03				
Cl.....		None				
SO <sub>3</sub> .....		.30				
BaO.....		.11				
B <sub>2</sub> O <sub>3</sub> .....		None				
	99.84	99.92	100.08	100.06	100.18	100.10

Five samples of gneiss from the Ajo quadrangle, collected by James Gilluly and analyzed by Charles Milton, record D-421.

G. Albite-chlorite gneiss, NE ¼ sec. 29, T. 12 S., R. 6 W. Pre-Tertiary, possibly pre-Cambrian. Quartz, albite, epidote, chlorite, muscovite, magnetite, and titanite.

H. Quartz diorite gneiss, same locality. Andesine, quartz, sericite, epidote, orthoclase, chlorite, biotite, and magnetite.

I. Quartz-albite gneiss, same locality. Quartz, albite, sericite, andesine, calcite, orthoclase, chlorite, biotite, zircon, titanite, magnetite, and apatite.

J. Biotite diorite gneiss, same locality. Quartz, andesine, biotite, chlorite, muscovite, magnetite, titanite, zircon, and apatite.

K. Porphyritic albite gneiss, SW ¼ sec. 28, T. 12 S., R. 6 W. Albite, sericite, quartz, epidote, chlorite, hornblende, titanite, apatite, and magnetite.

	G	H	I	J	K		G	H	I	J	K
SiO <sub>2</sub> .....	70.78	62.13	65.48	77.23	68.21	CO <sub>2</sub> .....	0.15	0.13	0.54	0.05	0.12
Al <sub>2</sub> O <sub>3</sub> .....	14.15	18.59	16.39	8.61	15.15	TiO <sub>2</sub> .....	1.08	.79	.80	1.19	.90
Fe <sub>2</sub> O <sub>3</sub> .....	3.19	2.09	1.31	4.25	3.14	ZrO <sub>2</sub> .....	.03	.04	Trace	.07	.02
FeO.....	2.00	3.24	2.32	1.97	2.26	P <sub>2</sub> O <sub>5</sub> .....	.04	.04	.10	.04	.06
MgO.....	1.60	1.72	1.56	1.11	1.88	S.....	.06	.12	.12	.01	.05
CaO.....	.71	3.10	2.93	1.57	2.57	MnO.....	.02	.04	.01	.03	.03
Na <sub>2</sub> O.....	2.16	4.09	3.63	2.20	3.47	BaO.....	.03	.07	.07	.02	.06
K <sub>2</sub> O.....	2.95	2.36	3.14	.81	1.44						
H <sub>2</sub> O.....	1.33	1.67	1.40	.81	1.32						
H <sub>2</sub> O+.....	.14	.29	.20	.07	.17		100.42	100.51	100.00	100.04	100.85



Five volcanic rocks from the Ajo quadrangle, collected by James Gilluly. Analyses L, M by R. E. Stevens; N-P by J. G. Fairchild, record D-427.

L. Andesitic basalt, north spur of Black Mountain, north center sec. 36, T. 12 S., R. 6 W. Plagioclase, augite, glass, magnetite.

M. Augite andesite, SE ¼ sec. 14, T. 13 S., R. 6 W. Augite, plagioclase, glass.

N. Olivine basalt, crest of Black Mountain, sec. 1, T. 13 S., R. 6 W. Olivine, iddingsite, augite, plagioclase, glass, magnetite.

O. Hornblende basalt, Childs Mountain, northwest corner sec. 6, T. 12 S., R. 6 W. Basaltic hornblende, augite, plagioclase, magnetite, glass.

P. Augite andesite, northwest spur of Childs Mountain, 5 miles west of Bata-mote Well. Augite, plagioclase, magnetite, glass.

	L	M	N	O	P		L	M	N	O	P
SiO <sub>2</sub> -----	59.88	56.66	54.79	58.42	55.61	TiO <sub>2</sub> -----	0.81	1.09	1.40	0.90	1.55
Al <sub>2</sub> O <sub>3</sub> -----	15.75	18.14	15.69	17.20	17.48	ZrO <sub>2</sub> -----	.04	.04	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> -----	3.10	5.61	3.92	4.29	5.09	CO <sub>2</sub> -----	.07	Trace	-----	.70	-----
FeO-----	3.31	1.65	4.19	1.41	2.81	P <sub>2</sub> O <sub>5</sub> -----	.36	.40	.21	.17	.61
MgO-----	2.76	1.05	5.85	3.08	1.46	S-----	.06	.05	-----	-----	-----
CaO-----	5.31	5.01	7.31	7.75	6.38	Cr <sub>2</sub> O <sub>3</sub> -----	None	None	-----	-----	-----
Na <sub>2</sub> O-----	3.62	4.39	3.30	3.48	3.40	V <sub>2</sub> O <sub>5</sub> -----	-----	-----	-----	.22	-----
K <sub>2</sub> O-----	3.25	4.00	2.05	1.94	3.65	MnO-----	.13	.10	.09	.09	.10
Rb <sub>2</sub> O-----	None	None	-----	-----	-----	BaO-----	.08	.09	-----	-----	-----
Cs <sub>2</sub> O-----	None	None	-----	-----	-----						
H <sub>2</sub> O-----	.74	.77	.63	.18	.50		99.99	99.69	100.50	100.93	99.89
H <sub>2</sub> O+-----	.72	.64	1.07	1.10	1.25						

OATMAN DISTRICT

Rocks collected by F. L. Ransome and described in part in Bull. 743, 1923. Analyses by R. C. Wells, record C-336.

A. Biotite-augite andesite (Oatman andesite). Between shaft 1 of the United Eastern mine and the main road in northern part of Oatman. No unusual minerals. A little free quartz, possibly an inclusion.

B. Biotite andesite, 0.8 mile north of Sitgreaves Pass. Small phenocrysts of plagioclase and biotite in microlitic glassy groundmass.

C. Biotite-hornblende andesite, 0.8 mile east-northeast of Sitgreaves Pass. Much like B but it is a distinct body and has larger phenocrysts of plagioclase and phenocrysts of hornblende.

D. Biotite andesite (?), 1.9 miles north-northeast of Sitgreaves Pass. Fresh perlitic and spherulitic glass with phenocrysts of plagioclase, biotite, titanite, and magnetite.

E. Doubtful rock apparently between andesite and rhyolite, 0.5 mile southeast of Elephant's Tooth. Small phenocrysts of plagioclase, biotite, quartz, andesite, and apatite in a groundmass of glass and obscure feldspars.

F. Biotite latite vitrophyre ("older andesite" of Schrader and of field notes), 0.3 mile west of summit of Leland Hill. Typical. As usual in this rock, biotite is chloritized. Originally glassy groundmass devitrified.

G. Biotite-pyroxene andesite, 0.75 mile southwest of Sunnyside mine, forming high cliffs. Perfectly fresh rock. Phenocrysts plagioclase, pyroxene, and biotite, with some magnetite and apatite, in a microlitic glassy groundmass.

H. Biotite-pyroxene andesite, 0.2 mile southeast of Sitgreaves Pass. Perfectly fresh. Same constituents as G.

I. Biotite-pyroxene andesite vitrophyre, 0.6 mile south of Sitgreaves Pass. Phenocrysts of plagioclase, biotite, and pyroxene, with magnetite and apatite, in a glassy groundmass. Perfectly fresh.

J. Biotite-pyroxene andesite vitrophyre, 1 ¼ miles east-southeast of Sunnyside mine. Evidently a perfectly fresh rock and probably like I.

K. Biotite-augite andesite (Oatman andesite), "green chloritic andesite" of Schrader, dump of abandoned shaft 0.9 mile south of Oatman. Phenocrysts plagioclase, biotite, and augite. Groundmass mainly feldspar, magnetite, and glass. A little calcite and chlorite.

L. Biotite latite vitrophyre ("older andesite"), 0.75 mile west-southwest of Moss mine. Phenocrysts of plagioclase and biotite in glassy, partly devitrified groundmass. Some apatite. A little chlorite and calcite.

M. Biotite latite vitrophyre ("older andesite"), 1 mile west-northwest of Mount Hardy. Like L.



N. Biotite latite, 0.25 mile east of Highland Cliff mine. Small phenocrysts of biotite and magnetite in a very fine-grained feldspathic groundmass. Some apatite.

O. Biotite-augite andesite, 0.2 mile southeast of Arizona-Rex mine. Phenocrysts plagioclase, biotite, magnetite, and quartz in glassy groundmass. Pyroxene very slightly altered to calcite. Fairly abundant apatite.

P. Granite porphyry, representative of large intrusive mass, north side of Times Gulch, 1¼ miles south of Cathedral Rock. Consists of micrographic intergrowth of quartz and orthoclase, with biotite and a little magnetite, titanite, and apatite.

Q. Quartz monzonite porphyry, representative of large intrusive mass, 0.75 mile north of Moss mine. Orthoclase, quartz, plagioclase, biotite, amphibole, magnetite, apatite, and titanite.

R. Rhyolite, Boundary Cone. An intrusive plug. Phenocrysts quartz and orthoclase in very fine-grained granular groundmass, probably quartz and orthoclase.

S. Biotite andesite (Oatman andesite), dump of lower west tunnel of Leland mine. Usual andesite composition. Some chlorite and calcite.

	A	B	C	D	E	F	G	H	I	J
SiO <sub>2</sub> .....	56.37	66.94	66.06	71.94	67.97	63.73	62.96	61.61	68.94	68.25
Al <sub>2</sub> O <sub>3</sub> .....	15.99	15.85	16.17	13.52	14.73	15.38	15.36	15.62	13.36	13.67
Fe <sub>2</sub> O <sub>3</sub> .....	2.56	3.14	4.23	1.09	2.34	3.05	2.57	3.46	1.29	1.93
FeO.....	3.41	.32	Trace	.37	.47	1.11	2.09	1.82	1.04	.91
MgO.....	2.97	.30	.69	.16	1.05	.78	2.50	2.13	.79	1.02
CaO.....	6.81	2.31	3.04	.95	1.52	1.82	4.26	4.55	2.02	2.30
Na <sub>2</sub> O.....	2.99	4.69	3.98	3.98	3.19	3.68	3.84	3.50	2.20	3.10
K <sub>2</sub> O.....	2.89	4.65	4.84	5.70	5.37	7.11	3.96	3.59	5.89	5.40
H <sub>2</sub> O.....	.38	.75	.16	.57	1.65	.52	.23	1.13	.28	.29
H <sub>2</sub> O+	1.66	.32	.27	1.65	1.29	.83	1.37	1.71	3.43	2.58
TiO <sub>2</sub> .....	1.16	.53	.60	.23	.48	.69	.72	.91	.47	.51
P <sub>2</sub> O <sub>5</sub> .....	.41	.17	.24	.04	.11	.37	.28	.28	.12	.45
MnO.....	.07	.05	.04	.06	.05	.03	.04	.04	.03	.04
CO <sub>2</sub> .....	2.18	None	None	None	None	.67	None	Trace	None	Trace
	99.85	100.02	100.32	100.26	100.22	99.77	100.18	100.35	99.85	100.45

  

	K	L	M	N	O	P	Q	R	S
SiO <sub>2</sub> .....	53.71	65.44	65.26	63.80	61.32	72.85	62.54	77.50	58.50
Al <sub>2</sub> O <sub>3</sub> .....	16.63	15.96	16.39	16.92	16.33	13.45	14.42	11.29	15.75
Fe <sub>2</sub> O <sub>3</sub> .....	3.97	1.63	1.98	3.35	2.85	1.11	3.51	.19	1.70
FeO.....	3.88	1.63	1.21	.47	1.75	.54	2.57	.34	3.05
MgO.....	3.69	.83	.83	.79	2.15	.24	2.41	.09	2.89
CaO.....	6.82	2.04	2.16	2.47	4.76	1.13	4.26	.25	5.54
Na <sub>2</sub> O.....	2.87	3.78	4.23	4.36	3.84	4.01	3.83	.37	2.68
K <sub>2</sub> O.....	2.30	6.49	6.30	5.05	4.17	5.40	3.98	8.96	4.13
H <sub>2</sub> O.....	.78	.11	.34	.72	.74	.08	.29	.22	.45
H <sub>2</sub> O+	2.01	.53	.47	.93	.65	.40	.84	.48	1.64
TiO <sub>2</sub> .....	1.40	.52	.55	.55	.75	.39	1.05	.14	1.21
P <sub>2</sub> O <sub>5</sub> .....	.44	.18	.14	.30	.37	.04	.36	.04	.37
MnO.....	.07	.05	.05	.07	.05	.06	.07	None	.05
CO <sub>2</sub> .....	1.39	.54	.14	.02	.25	.27	None	.02	1.19
	99.96	99.73	100.05	99.80	99.98	99.97	100.13	99.89	100.05

## MISCELLANEOUS ROCKS

A-C. Collected by F. L. Ransome and described in Prof. Paper 115, 1919. Analyses A and B by George Steiger, record 3173.

A. Pinal schist, Ray district, from south slope of Red Hills. Quartz, sericite, biotite, magnetite.

B. From dump of Prospect mine, Webster Gulch, Miami. Sericite prominent.

C. Leached rock, Miami mine, Miami. Analysis by Chase Palmer, record 3048.

D. Rock from Mascot mine, Dos Cabezas Range, collected by E. L. Jones, Jr. Analysis by R. C. Wells, record 3019.

E. "Schist" or possibly pinitite, Glendale. Partial analysis by A. A. Chambers, record 3076.



	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> .....	65.58	66.84	68.30	73.35	46.10	H <sub>2</sub> O-----	0.22	0.17	0.15	} 2.14	{-----
Al <sub>2</sub> O <sub>3</sub> .....	16.47	17.46	17.41	} 15.14	{ 36.34	H <sub>2</sub> O+-----	2.27	2.61	2.44		
Fe <sub>2</sub> O <sub>3</sub> .....	4.19	4.88	3.80					TiO <sub>2</sub> -----	.83	.67	.66
FeO.....	2.25	.74	.15			CO <sub>2</sub> -----			None		
MgO.....	1.29	1.14	.83	.14		P <sub>2</sub> O <sub>5</sub> -----	.06	.03	.47		
CaO.....	1.29	.37	.04	2.06		MnO-----	.06	.02	Trace		
Na <sub>2</sub> O.....	1.42	.53	.53	3.36	1.11						
K <sub>2</sub> O.....	4.58	4.65	5.71	3.91	10.01						
							100.51	100.11	100.49	100.10	96.04

ARKANSAS

Two samples submitted by C. S. Ross, from Howard County. Analyses by George Steiger, record C-600.

- A. Phonolite low in femic minerals from Mine Creek, 4 miles north of Nashville.
- B. Trachyte from Temperance Branch, 3 miles northwest of Nashville.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	58.77	62.97	K <sub>2</sub> O-----	5.71	10.80	BaO-----	Trace	
Al <sub>2</sub> O <sub>3</sub> .....	20.60	19.00	H <sub>2</sub> O-----	.89	.72	SrO-----	0.01	
Fe <sub>2</sub> O <sub>3</sub> .....	1.40	} 1.13	H <sub>2</sub> O+-----	2.19	1.26	CO <sub>2</sub> -----	None	None
FeO.....	1.36		TiO <sub>2</sub> -----	.37	.26	ZrO <sub>2</sub> -----	.08	None
MgO.....	.54	.26	P <sub>2</sub> O <sub>5</sub> -----	.03	.10			
CaO.....	.79	.54	S-----	.04			100.18	99.90
Na <sub>2</sub> O.....	7.16	2.86	MnO-----	.24				

AUSTRIA

Serpentine of the picrolite type from Carnot (?), Tyrol. Submitted by C. S. Ross. Analysis by J. G. Fairchild, record C-993.

SiO <sub>2</sub> .....	40.97	FeO-----	Trace	H <sub>2</sub> O-----	13.80
Al <sub>2</sub> O <sub>3</sub> .....	None	MgO-----	40.43	TiO <sub>2</sub> -----	None
Fe <sub>2</sub> O <sub>3</sub> .....	5.55	CaO-----	None		
					100.75

BERMUDA

Altered lava, augite andesite, from well 1,110 feet deep, collected by L. V. Pirsson. Analysis by R. C. Wells, record 2871. Association of the rock described by Pirsson and Vaughan, Am. Jour. Sci., 4th ser., vol. 36, pp. 70-71, 1913.

SiO <sub>2</sub> .....	38.79	CaO-----	14.65	TiO <sub>2</sub> -----	0.80
Al <sub>2</sub> O <sub>3</sub> .....	14.55	Na <sub>2</sub> O-----	2.78	CO <sub>2</sub> -----	3.56
Fe <sub>2</sub> O <sub>3</sub> .....	5.67	K <sub>2</sub> O-----	2.54		
FeO.....	6.68	H <sub>2</sub> O-----	.67		100.46
MgO.....	7.78	H <sub>2</sub> O+-----	1.99		

CALIFORNIA

IVANPAH QUADRANGLE

Granites and latites collected by D. F. Hewett. Analyses by J. G. Fairchild, record C-999.

- A. Kingston laccolith.
- B. Granite, Erie Crater.
- C. Volcanic neck east of Erie.
- D. Rhyolite, Devils Peak.
- E. Granite, Columbia Well.
- F. Granite, Leiser Ray mine.
- G. Piute Mountain.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	71.50	66.81	68.53	73.58	67.04	71.77	69.01
Al <sub>2</sub> O <sub>3</sub> .....		16.16			15.37	14.60	
Fe <sub>2</sub> O <sub>3</sub> .....		2.01			1.06	.77	
FeO.....		1.25			2.51	1.77	
MgO.....		.72			1.33	.20	
CaO.....	1.00	2.62	.51	.05	3.64	1.95	2.31
Na <sub>2</sub> O.....	4.17	3.42	3.48	2.99	3.10	3.85	3.91
K <sub>2</sub> O.....	5.91	5.66	6.19	5.52	4.61	4.31	4.76
H <sub>2</sub> O-----		.10			.12	None	
H <sub>2</sub> O+-----		.48			.40	.53	
TiO <sub>2</sub> -----		.35			.45	.20	
		99.58			99.63	99.85	



## LASSEN PEAK

Rocks collected by J. S. Diller. A to D analyzed by W. C. Wheeler, record 2966.

A. Basalt, 7 miles southeast of Peak, Lake Tartarus.

B. Volcanic ash, collected September 14, 1914.

C. Solfataric mud, 6 miles southeast of Peak, Devil's Kitchen.

D. Solfataric mud, Lake Tartarus.

E. Dacite lava, Devil's Kitchen. Analysis by George Steiger, record 3084.

	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> -----	57.25	63.86	54.97	47.51	64.52	TiO <sub>2</sub> -----	0.42	0.45	0.83	0.65	0.59
Al <sub>2</sub> O <sub>3</sub> -----	18.25	16.07	27.72	34.08	16.77	ZrO <sub>2</sub> -----	.01	.04	.03	.09	None
Fe <sub>2</sub> O <sub>3</sub> -----	1.44	1.56	.88	1.17	1.19	P <sub>2</sub> O <sub>5</sub> -----	.18	.12	.11	.81	.12
FeO-----	4.73	2.31	.32	.52	2.82	S-----	None	.84	1.11	.63	.02
MgO-----	4.57	2.11	.20	.28	2.60	MnO-----	.11	.05	None	Trace	.06
CaO-----	8.12	4.94	.39	.08	5.09	BaO-----	.05	.03	.03	.05	.04
Na <sub>2</sub> O-----	2.85	3.59	.41	.21	3.78	SrO-----	.08	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	.02
K <sub>2</sub> O-----	.99	1.91	.46	.11	2.09	Li <sub>2</sub> O-----	Trace	Trace	Trace	Trace	-----
H <sub>2</sub> O-----	.31	1.47	2.54	1.89	.12						
H <sub>2</sub> O+-----	.65	.81	9.93	11.60	.51		100.01	100.16	99.93	99.68	100.34

<sup>1</sup> Undetermined.

A series of rocks collected by Howel Williams in the Lassen National Park. Analyses by George Steiger, record D-29.

F. Recent pyroxene basalt.

G. Recent basalt, northeast of Butte lake.

H. Augite andesite, east slope of Mount Harkness.

I. Pyroxene andesite, Crystal Cliff, east of Juniper Lake.

J. Pyroxene andesite, Saddle Mountain, Warren Valley.

K. Black andesite of central plateau, east of Hat Mountain.

L. Old pyroxene basalt, Badger Mountain.

M. Hornblende-mica dacite, Divide Peak.

N. Augite andesite, Divide Peak, near Hat Creek.

O. Augite andesite, south slope of Brockeoff Mountain, above Huckleberry Lake.

	F	G	H	I	J	K	L	M	N	O
SiO <sub>2</sub> -----	57.00	54.83	47.43	63.50	62.75	59.85	61.93	70.93	57.85	59.50
Al <sub>2</sub> O <sub>3</sub> -----	16.66	17.05	13.19	16.76	16.94	16.68	16.37	14.31	16.71	17.16
Fe <sub>2</sub> O <sub>3</sub> -----	.94	1.47	5.63	1.49	1.99	1.23	1.15	1.30	.88	2.27
FeO-----	5.40	5.79	7.04	2.80	2.46	4.40	3.90	1.26	4.93	3.94
MgO-----	5.12	5.47	5.20	2.90	3.27	3.85	3.26	.94	6.07	3.66
CaO-----	7.90	7.72	9.39	5.80	6.00	7.66	6.24	3.24	8.30	7.07
Na <sub>2</sub> O-----	3.46	3.60	2.58	3.59	3.55	3.62	3.37	4.30	3.04	3.63
K <sub>2</sub> O-----	1.22	1.77	1.79	2.22	2.46	1.46	2.00	2.76	1.18	1.50
H <sub>2</sub> O-----	.29	.27	2.02	.21	.28	.20	.18	.16	.16	.27
H <sub>2</sub> O+-----	.64	.73	1.38	.35	.13	.53	.74	.65	.32	.41
TiO <sub>2</sub> -----	.90	1.25	4.00	.65	.62	.65	.60	.26	.60	.89
P <sub>2</sub> O <sub>5</sub> -----	.29	.42	.55	.18	.11	.15	.16	.12	.13	.17
MnO-----	.12	.11	.12	.07	.07	.12	.08	.06	.09	.08
BaO-----	.02	.03	.04	.03	.04	.03	.04	.05	.02	.02
	99.96	100.51	100.36	100.55	100.67	100.43	100.02	100.34	100.28	100.57

## MOUNT WHITNEY QUADRANGLE

Three rocks collected and described by Adolph Knopf, Prof. Paper 110, 1918. Analyses by R. C. Wells, record 2892.

A. Granite, Ransom Creek, altitude 6,000 feet. Quartz, orthoclase, albite, anorthite, biotite.

B. Quartz monzonite, Lone Pine Creek, altitude 6,700 feet. Plagioclase, orthoclase, quartz, biotite, hornblende, titanite.

C. Quartz monzonite, altitude 13,000 feet. Quartz, orthoclase, plagioclase, biotite, hornblende, magnetite, titanite, apatite.



	A	B	C		A	B	C
SiO <sub>2</sub> .....	76.28	66.68	69.01	TiO <sub>2</sub> .....		0.64	0.49
Al <sub>2</sub> O <sub>3</sub> .....		15.12	15.44	CO <sub>2</sub> .....		None	Trace
Fe <sub>2</sub> O <sub>3</sub> .....		1.66	1.28	P <sub>2</sub> O <sub>5</sub> .....		.21	.24
FeO.....		2.49	1.28	S.....		Trace	Trace
CaO.....	.47	4.09	2.54	MnO.....		.01	.01
MgO.....		1.38	.62	SrO.....		Trace	Trace
Na <sub>2</sub> O.....	4.72	2.23	3.85				
K <sub>2</sub> O.....	4.73	4.97	4.52			100.30	100.17
H <sub>2</sub> O.....		.31	.33				
H <sub>2</sub> O+.....		.51	.56	Specific gravity.....	2.615	2.715	2.664

PALA DISTRICT

Rocks collected and analyzed by W. T. Schaller, record 2869.

A. Albitite dike near Pala.

B. Graphitic granite, Anita gem tourmaline mine, Riverside County.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	59.71	73.93	MgO.....	None	0.08	Ignition.....	0.86	0.16
Al <sub>2</sub> O <sub>3</sub> .....	25.47	13.77	CaO.....	8.24	4.48	CO <sub>2</sub> .....	Trace	Trace
Fe <sub>2</sub> O <sub>3</sub> .....	.17	.25	K <sub>2</sub> O.....	.22	9.16	P <sub>2</sub> O <sub>5</sub> .....	Trace	None
FeO.....	.22	.19	Na <sub>2</sub> O.....	5.48	2.00			
MnO.....	None	.03	Li <sub>2</sub> O.....	None	Trace	Total.....	100.37	100.05

MISCELLANEOUS ROCKS

A. Volcanic ash from north flank of Santa Monica Mountains, Los Angeles County, collected by M. N. Bramlette. Analysis by Charles Milton, record D-180. For bentonite resulting from the decomposition of this rock see "Clays."

B. Hydrothermally altered greenstone from Mother Lode district, collected by Adolph Knopf and described in Prof. Paper 157, 1929. Analysis by J. G. Fairchild, record C-699. Ankerite, sericite, quartz, albite, rutile, pyrite, and minor arsenopyrite.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	65.66	34.17	Na <sub>2</sub> O.....	1.10	1.65	P <sub>2</sub> O <sub>5</sub> .....	0.06	-----
Al <sub>2</sub> O <sub>3</sub> .....	12.71	<sup>1</sup> 15.82	K <sub>2</sub> O.....	1.73	4.63	MnO.....	None	-----
Fe <sub>2</sub> O <sub>3</sub> .....	1.94	.69	H <sub>2</sub> O.....	4.34	None	BaO.....	.17	-----
FeO.....	1.60	7.61	H <sub>2</sub> O+.....	8.03	1.94	FeS <sub>2</sub> .....	-----	2.74
MgO.....	.71	5.77	TiO <sub>2</sub> .....	.40	1.49			
CaO.....	1.44	8.75	CO <sub>2</sub> .....	-----	15.50		99.89	100.76

<sup>1</sup> Includes P<sub>2</sub>O<sub>5</sub> if present.

C-H. Graphitic schists. Determinations of graphite by George Steiger, records 3021, 3027, and 2880. C, 11.90; D, 17.48; E, 12.00; F, 7.29; G, 16.2; H, 10.4.

C. Eighty miles northeast of San Diego.

D-F. Twenty miles northeast of Saugus.

G. Leyeo prospect, San Diego County.

H. Mine of California Graphite Co., Saugus.

COLORADO

BONANZA DISTRICT

Rocks collected by W. S. Burbank and described in Prof. Paper 169, 1932. Analyses by J. G. Fairchild, record C-1010.

A. Augite-biotite andesite from ridge just below Superior mine.

B. Similar latite near top of Rawley andesite near mine.

C. Altered andesite, Rawley drainage tunnel, 4,450 feet from portal.

D. Same, 4,070 feet from portal. Red jasper type of alteration.

E. Same with pyrite crystals, 2,600 feet from portal.

F. Silicified andesite, ridge north of Express Gulch.

G. Volcanic rock with kaolin mineral from Greenback Gulch.

H. Same from hill between Greenback and Chloride Gulches.



	A	B	C	D	E	F	G	H
SiO <sub>2</sub> .....	57.62	59.66	61.28	88.73	66.48	95.18	82.57	93.17
Al <sub>2</sub> O <sub>3</sub> .....	15.84	16.09	2.42	.97	1.64	1.20	11.44	2.52
Fe <sub>2</sub> O <sub>3</sub> .....	3.05	2.57	31.49	3.50	.64	.77	.16	.19
FeO.....	3.90	3.53	2.49	3.56	2.74	2.27	.65	1.92
MgO.....	2.14	2.29	.05	.05	Trace	Trace	Trace?	.03
CaO.....	4.81	4.48	.28	.24	.20	Trace	None	.05
Na <sub>2</sub> O.....	3.07	3.08	Trace	Trace	Trace	Trace	Trace	Trace
K <sub>2</sub> O.....	4.95	4.92	.19	Trace	.27	Trace	1.89	.15
H <sub>2</sub> O.....	.24	.25	.05	.02	Trace	None	.43	.09
H <sub>2</sub> O+.....	1.39	1.84	.58	.69	1.64	.40	2.98	1.03
TiO <sub>2</sub> .....	1.30	1.00	.50	1.50	1.45	.25	.35	.63
CO <sub>2</sub> .....	1.06	.10	None					
P <sub>2</sub> O <sub>5</sub> .....	.44	.35	.20	.20	.43	.06	.09	.10
SO <sub>2</sub> .....	.05		.28	(1)	None	Trace	.12	.20
Cl.....			Trace	(1)	.09			
S.....			.06		Present			
MnO.....	.15							
BaO.....	.04		.30	None	Trace?	None	.06	.07
FeS <sub>2</sub> .....			Trace		24.96			
ZnS.....			None		.05			
	100.05	100.16	100.17	99.46	100.59	100.13	100.74	100.15
Specific gravity of particles.....	2.732	2.723	3.227	2.786	3.106	2.688		
Specific gravity of lump.....	2.713	2.686	3.072	2.667	2.998	2.598		

1 Undetermined.

#### BRECKENRIDGE DISTRICT

Rocks described by F. L. Ransome in Prof. Paper 75, 1911. Analyses by R. C. Wells, record 2426, with corrected fluorine determinations by J. G. Fairchild.

A. Quartz monzonite porphyry, Brewery Hill. Plagioclase, orthoclase, quartz, biotite, magnetite, pyrite, apatite, titanite, zircon, and allanite, with very little calcite and chlorite.

B. Quartz monzonite porphyry, Browns Gulch. Orthoclase, plagioclase, quartz, biotite, apatite, rarely allanite, and secondary epidote, calcite, chlorite, and pyrite.

C. Quartz monzonite porphyry, Mount Guyot. Labradorite, orthoclase, quartz, biotite, hornblende, titanite, and magnetite.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	67.53	68.14	64.28	F.....	0.07	0.04	0.02
Al <sub>2</sub> O <sub>3</sub> .....	15.46	15.29	16.99	S.....	.05	.81	None
Fe <sub>2</sub> O <sub>3</sub> .....	2.24	1.36	2.59	V <sub>2</sub> O <sub>5</sub> .....			.03
FeO.....	2.42	1.66	2.64	Cr <sub>2</sub> O <sub>3</sub> .....	None		
MgO.....	.16	.26	1.13	NiO.....	None	.01	None
CaO.....	3.24	3.03	3.95	MnO.....	.10	.12	.14
Na <sub>2</sub> O.....	3.24	3.59	3.78	BaO.....	.07	.03	.10
K <sub>2</sub> O.....	3.86	4.07	3.51	SrO.....	None	.03	.04
H <sub>2</sub> O.....	.23	.40	.07	Li <sub>2</sub> O.....			None
H <sub>2</sub> O+.....	.55	.39	.25				
TiO <sub>2</sub> .....	.41	.36	.49		99.69	99.99	100.34
ZrO <sub>2</sub> .....	.02	.01	.01	Less O.....	.05	.32	.01
CO <sub>2</sub> .....	.03	.22	None				
P <sub>2</sub> O <sub>5</sub> .....	.01	.17	.32		99.64	99.67	100.33

#### COCHETOPA QUADRANGLE

Rocks collected by E. S. Larsen. Analyses by J. G. Fairchild, record C-663.

A. Augite-hornblende andesite of the middle horizon, north of the Saguache River, on trail near head of Spanish Creek, 1 mile from point where trail leaves creek.

B. Sheep Mountain andesite, upper horizon, Continental Divide, 0.75 mile east of point where long branch trail crosses divide. Chemically rhyolite.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	58.31	70.93	CaO.....	6.07	1.28	TiO <sub>2</sub> .....	1.00	0.30
Al <sub>2</sub> O <sub>3</sub> .....	16.55	15.87	Na <sub>2</sub> O.....	4.00	4.21	P <sub>2</sub> O <sub>5</sub> .....	.33	Trace
Fe <sub>2</sub> O <sub>3</sub> .....	5.30	.85	K <sub>2</sub> O.....	3.52	5.33			
FeO.....	1.36	.33	H <sub>2</sub> O.....	1.02	.15		99.94	100.52
MgO.....	2.12	.08	H <sub>2</sub> O+.....	.36	1.19			



CONEJOS QUADRANGLE

Rocks collected by E. S. Larsen.

A. Fine-grained olivine andesite, northeast shoulder of Green Mountain, halfway up to the top. Less than 1 percent of olivine phenocrysts, augite 18 percent, a little hypersthene, much andesine, and considerable magnetite. Analysis by Glenn V. Brown, record 3270.

B. Similar rock analyzed by George Steiger, record 3252.

C. Pyroxene andesite from the Conejos River 4 miles southeast of west border of quadrangle, at an altitude of 11,000 feet. Analysis by R. K. Bailey, record C-421-a.

D. Hornblende andesite from north base of McIntyre Mountain. Analysis by J. G. Fairchild, record C-421-b.

E. Felsitic quartz latite from east slope of Caldwell Mountain at an altitude of 10,500 feet. Analysis by J. G. Fairchild, record C-663.

F. Biotite-quartz latite from northwestern part of the quadrangle, along trail from the Alamosa River to the head of Cat Creek and 2 miles north of Alamosa ranger station. Analyses F and G by J. G. Fairchild, record C-421-b.

G. Pyroxene-hornblende andesite, low in dark minerals, from saddle 1 mile south of Bennet Peak.

H. Rhyolite tuff from west slope of McIntyre Point at an altitude of 9,650 feet. Analysis by J. G. Fairchild, record C-493.

I. Treasure Mountain quartz latite from west slope of McIntyre Point at an altitude of 9,840 feet. Analyses I to L by J. G. Fairchild, records C-614 and C-663.

J. Biotite-augite latite from same locality at an altitude of 10,000 feet.

K. Latite of Chiquita Peak, northeast slope of Green Mountains along the ridge at an altitude of 8,750 feet.

L. Andesite-basalt of Hinsdale formation, cliffs north of Mogote Peak.

M. Basalt, intrusive phase, Las Mogotes Peak. Plagioclase, 62 percent; augite, 20 percent; olivine, iron oxide, 5 percent each, and secondary minerals, 8 percent. Analysis by G. V. Brown, record 3270.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	55.21	55.55	60.41	59.85	64.60	64.28	64.21
Al <sub>2</sub> O <sub>3</sub> .....	15.72	14.89	16.20	17.31	16.71	17.16	16.31
Fe <sub>2</sub> O <sub>3</sub> .....	4.56	4.28	4.80	5.36	3.67	3.84	2.87
FeO.....	4.58	4.22	2.24	.55	.30	.52	1.23
MgO.....	4.17	3.90	2.21	1.96	1.05	.55	1.17
CaO.....	6.67	6.35	6.37	5.60	3.45	1.85	3.61
Na <sub>2</sub> O.....	2.89	4.35	4.02	3.16	4.35	3.94	2.76
K <sub>2</sub> O.....	4.14	3.36	2.64	2.90	4.41	5.38	4.26
H <sub>2</sub> O.....	.61	.42	.44	.46	.20	1.03	.44
H <sub>2</sub> O+.....	.13	.72	.12	1.64	1.06	1.05	2.69
TiO <sub>2</sub> .....	1.45	1.40	1.00	.63	.60	.90	.57
P <sub>2</sub> O <sub>5</sub> .....	None	.98	None	.31	.20	.20	.20
MnO.....	.06	.12	.10	.11	-----	Trace	.06
SrO.....	.04	.07	-----	-----	-----	-----	-----
BaO.....	-----	.07	-----	-----	-----	-----	-----
CO <sub>2</sub> .....	-----	-----	None	-----	Trace	-----	-----
	100.23	100.68	100.55	99.84	100.60	100.70	100.38

  

	H	I	J	K	L	M
SiO <sub>2</sub> .....	61.76	68.40	66.96	61.52	50.95	50.18
Al <sub>2</sub> O <sub>3</sub> .....	15.42	14.90	16.19	16.12	16.10	16.47
Fe <sub>2</sub> O <sub>3</sub> .....	4.25	2.74	2.99	3.36	6.01	8.92
FeO.....	.51	.36	.49	2.32	4.23	2.60
MgO.....	1.95	.12	.16	2.03	7.02	6.98
CaO.....	3.50	2.21	2.86	4.73	8.24	9.30
Na <sub>2</sub> O.....	2.66	4.24	4.65	3.72	3.59	2.74
K <sub>2</sub> O.....	3.84	5.21	4.88	3.70	1.73	1.04
H <sub>2</sub> O.....	2.08	.43	.26	.12	.05	.08
H <sub>2</sub> O+.....	2.90	.47	.10	1.84	.61	.35
TiO <sub>2</sub> .....	.63	.68	.63	1.00	1.62	1.60
P <sub>2</sub> O <sub>5</sub> .....	.27	.14	.17	.27	.13	.29
MnO.....	Trace	-----	.14	-----	.11	None
SrO.....	-----	-----	Trace	-----	-----	.03
BaO.....	-----	-----	.13	-----	-----	-----
CO <sub>2</sub> .....	-----	-----	-----	-----	-----	-----
ZrO <sub>2</sub> .....	-----	-----	.03	-----	-----	-----
	99.77	99.90	100.64	100.73	100.39	100.58



## CREEDE QUADRANGLE

Latite-andesites collected by E. S. Larsen. Analyses A-C by George Steiger, record C-651; D-E and H-J by J. G. Fairchild, records C-547, C-474, and C-663; F-G by R. K. Bailey, record C-474.

A. Table Mountain.

B. East of Farmers Creek.

C. Under benchmark 12029, Nelson Mountain, Creede and vicinity quadrangle.

D. Nearly black hornblende-pyroxene andesite from shoulder of Mount Hope, at 12,500 feet.

E. Hornblende-pyroxene andesite from ridge east of Table Mountain, at 12,350 feet.

F. Quartz-biotite-pyroxene latite-andesite from west edge of mesa between forks of Bellows Creek, north of the Rio Grande, a little north of point 11,511 of topographic map.

G. Biotite-hornblende-quartz latite from draw on west slope of hill 9740, north of the Rio Grande, between Farmers and Bellows Creeks, at 9,100 feet.

H. Quartz latite from eastern part of quadrangle about 2 miles east of the village of South Fork, south of the Rio Grande, at 8,800 feet, in the small gulch on the road to the head of Willow Creek.

I. Latite from Alder Creek, Alboroto type.

J. Fisher latite-andesite from southeast slope of McClelland Mountain, at 1,065 feet.

	A	B	C	D	E	F	G	H	I	J
SiO <sub>2</sub> .....	69.66	64.27	65.34	59.26	59.95	60.54	64.59	61.80	64.93	65.29
Al <sub>2</sub> O <sub>3</sub> .....	14.92	17.89	16.00	17.27	16.92	16.01	15.22	16.13	15.59	15.56
Fe <sub>2</sub> O <sub>3</sub> .....	2.10	2.38	3.96	3.63	4.70	3.63	2.73	6.40	3.46	4.13
FeO.....	.36	.58	.61	3.30	2.42	2.34	1.79	.32	.94	.55
MgO.....	.74	.57	.78	2.01	1.64	2.49	1.83	1.32	1.41	.78
CaO.....	1.89	2.82	3.61	6.01	5.83	5.44	3.91	4.08	3.68	3.41
Na <sub>2</sub> O.....	4.24	4.32	3.96	3.32	3.12	2.40	3.52	3.50	3.60	3.66
K <sub>2</sub> O.....	4.55	4.67	3.59	2.50	2.78	3.68	3.72	3.82	4.05	4.61
H <sub>2</sub> O.....	.17	.46	.52	.17	.60	.23	.59	.79	.81	.60
H <sub>2</sub> O+.....	.31	.75	.38	.71	.88	1.07	1.27	.89	.57	.94
TiO <sub>2</sub> .....	.42	.48	.59	.91	.91	1.10	.70	1.00	.70	.85
ZrO <sub>2</sub> .....	.05	.05	.04	.....	.....	.....	.....	.....	.....	.....
CO <sub>2</sub> .....	None	.15	None	.....	.....	.....	.....	.....	.....	.....
P <sub>2</sub> O <sub>5</sub> .....	.09	.10	.18	.32	.31	.51	.29	.32	.23	.26
MnO.....	.10	.07	.09	.....	.08	.....	.....	.....	.....	.....
BaO.....	.12	.29	.08	.....	.....	.....	.....	.....	.....	.....
SrO.....	.....	.02	.....	.....	.....	.....	.....	.....	.....	.....
	99.72	99.87	99.73	99.41	100.14	99.44	100.16	100.37	99.97	100.64

Tridymite latite collected by Whitman Cross 100 yards north of schoolhouse at Bachelor and described by Emmons and Larsen in Bull. 718, p. 45, 1923. A third consists of phenocrysts of orthoclase, andesine, some biotite, and accessory apatite, magnetite, and zircon. The fluidal ground mass is made up of felsitic intergrowths of alkali feldspar and tridymite. Analysis by George Steiger, record 2875.

SiO <sub>2</sub> .....	67.76	K <sub>2</sub> O.....	4.91	S.....	0.02
Al <sub>2</sub> O <sub>3</sub> .....	16.08	H <sub>2</sub> O.....	.94	MnO.....	.04
Fe <sub>2</sub> O <sub>3</sub> .....	2.22	H <sub>2</sub> O+.....	.54	BaO.....	.12
FeO.....	.23	TiO <sub>2</sub> .....	.45	SrO.....	.03
MgO.....	.43	ZrO <sub>2</sub> .....	.02		
CaO.....	2.59	CO <sub>2</sub> .....	None	Total.....	100.55
Na <sub>2</sub> O.....	4.06	P <sub>2</sub> O <sub>5</sub> .....	.11		

## DEL NORTE QUADRANGLE

Rocks collected by E. S. Larsen.

A. Quartz latite from Carnero Creek, 200 yards north of the main forks. Analysis by George Steiger, record C-651.

B. Tridymite latite-andesite from canyon of Carnero Creek about 3 miles above La Garita post office. Phenocrysts of andesine, hornblende, biotite, auge, hypersthene, magnetite, and apatite, in ground mass of oligoclase, orthoclase, quartz, and hematite. Analysis by R. K. Bailey, record C-474.



C. Tabular feldspar-pyroxene andesite from a flow 0.75 mile east of west boundary of quadrangle on north bank of La Garita Creek. Analysis by J. G. Fairchild, record 3293.

D. Vitreous hornblende-augite-quartz latite from locality near head of Bear Creek in northwestern part of quadrangle. Fragment from breccia bed near the base of the section. Analysis by George Steiger, record C-651.

E. Soda rhyolite from dike west of center of quadrangle, southwest of diorite stock of Summer Creek. Analysis by George Steiger, record 3252.

	A	B	C	D	E
SiO <sub>2</sub> .....	64.66	59.95	54.84	65.29	71.21
Al <sub>2</sub> O <sub>3</sub> .....	15.46	14.62	18.28	16.17	15.24
Fe <sub>2</sub> O <sub>3</sub> .....	4.05	5.30	3.98	1.54	1.46
FeO.....	.78	1.26	2.97	1.70	.33
MgO.....	1.56	2.76	2.55	1.23	.20
CaO.....	4.12	5.35	7.24	3.00	1.56
Na <sub>2</sub> O.....	4.42	4.06	4.10	3.76	4.41
K <sub>2</sub> O.....	2.45	3.52	3.38	3.93	4.75
H <sub>2</sub> O.....	.54	.55	.99	.22	.44
H <sub>2</sub> O+.....	.56	1.13	.41	2.24	.64
TiO <sub>2</sub> .....	.71	1.88	1.40	.62	.24
ZrO <sub>2</sub> .....	None			.05	
CO <sub>2</sub> .....				None	
P <sub>2</sub> O <sub>5</sub> .....	.32	.45	.49	.10	.10
MnO.....	.03		.08	.08	(1)
BaO.....	.08			.15	(1)
SrO.....					.03
Total.....	99.74	100.33	100.71	100.08	100.61

<sup>1</sup> Undetermined.

LEADVILLE DISTRICT

Fresh Mount Zion porphyry collected by G. F. Loughlin and described in Prof. Paper 148, 1927. Oligoclase-andesine 35 percent, orthoclase 28 percent, quartz 17 percent, chlorite 10 percent, magnetite 5 percent, calcite 5 percent, apatite less than 1 percent. Analysis by J. G. Fairchild, record C-519.

SiO <sub>2</sub> .....	63.25	CaO.....	2.99	CO <sub>2</sub> .....	0.88
Al <sub>2</sub> O <sub>3</sub> .....	16.16	Na <sub>2</sub> O.....	3.54	TiO <sub>2</sub> .....	.50
Fe <sub>2</sub> O <sub>3</sub> .....	2.60	K <sub>2</sub> O.....	3.26	P <sub>2</sub> O <sub>5</sub> .....	.30
FeO.....	2.44	H <sub>2</sub> O.....	.63		
MgO.....	1.62	H <sub>2</sub> O+.....	1.85		100.02

NEDERLAND DISTRICT

Granitic gneiss collected by T. S. Lovering. Analyses by J. G. Fairchild, record D-35.

A-D from fifth level of Coldspring mine close to new shaft, about 3 miles north-east of Nederland.

E-F from vein near breast of Lilly tunnel, 2 miles northeast of Nederland.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	65.67	63.34	66.61	68.71	65.08	66.31
Al <sub>2</sub> O <sub>3</sub> .....	16.52	18.21	15.13	14.93	15.26	15.07
Fe <sub>2</sub> O <sub>3</sub> .....	1.21	.79	1.40	1.02	1.30	1.35
FeO.....	2.53	2.44	2.26	2.07	2.90	2.71
MgO.....	1.00	1.08	1.45	1.50	.93	1.03
CaO.....	.08	.40	1.23	2.01	.43	2.06
Na <sub>2</sub> O.....	.81	.41	1.20	2.85	.94	2.48
K <sub>2</sub> O.....	6.70	6.11	5.02	5.14	8.63	5.96
H <sub>2</sub> O.....	.94	.71	1.45	.14	.17	.06
H <sub>2</sub> O+.....	2.34	4.07	2.08	.56	1.38	.90
TiO <sub>2</sub> .....	.33	.75	.54	.62	.75	.66
CO <sub>2</sub> .....	1.70	1.16	1.09	.46	1.75	.98
P <sub>2</sub> O <sub>5</sub> .....	.22	.24	.19	.16	.31	.32
SO <sub>3</sub> .....					.64	
S (total).....	.02	.04	.02	Trace?		.04
Total.....	100.07	99.75	99.67	100.17	100.47	99.93



Three igneous rocks from Boulder County, collected by E. N. Goddard. Analyses by R. E. Stevens, record D-455.

G. Biotite-sillimanite schist, 2½ miles S. 60° E. of Jamestown. Biotite, sillimanite, quartz, and muscovite.

H. Augite porphyry, 0.9 mile S. 80° E. of Sugarloaf Mountain, Nederland district. Augite, olivine, magnetite, and glass.

I. Hornblende monzonite, 1,700 feet west of Silver Queen mine, Nederland district. Large phenocrysts of oligoclase, hornblende, and some magnetite in a fine-grained groundmass of quartz and orthoclase.

	G	H	I		G	H	I
SiO <sub>2</sub> .....	42.20	37.83	63.39	H <sub>2</sub> O-.....	0.19	1.24	0.13
Al <sub>2</sub> O <sub>3</sub> .....	35.45	8.52	16.75	H <sub>2</sub> O+.....	3.29	2.56	.93
Fe <sub>2</sub> O <sub>3</sub> .....	1.70	6.48	1.83	TiO <sub>2</sub> .....	1.25	1.35	.35
FeO.....	8.18	5.52	3.05	CO <sub>2</sub> .....	Trace	6.08	.09
MgO.....	2.80	11.44	.90	P <sub>2</sub> O <sub>5</sub> .....	.06	1.02	.39
CaO.....	.18	13.80	3.85	MnO.....	.09	.21	.14
Na <sub>2</sub> O.....	.62	2.82	4.26				
K <sub>2</sub> O.....	4.32	1.15	3.61				
					100.33	100.02	99.67

## SAGUACHE QUADRANGLE

Sheep Mountain andesite, lower horizon, collected by E. S. Larsen from south side of Saguache Creek, about 0.25 mile below mouth of Ford Creek, altitude 8,400 feet. Analysis by J. G. Fairchild, record C-663.

SiO <sub>2</sub> .....	60.67	CaO.....	4.05	TiO <sub>2</sub> .....	0.80
Al <sub>2</sub> O <sub>3</sub> .....	17.50	Na <sub>2</sub> O.....	4.45	P <sub>2</sub> O <sub>5</sub> .....	.38
Fe <sub>2</sub> O <sub>3</sub> .....	3.86	K <sub>2</sub> O.....	4.19		
FeO.....	.95	H <sub>2</sub> O-.....	1.09		
MgO.....	1.79	H <sub>2</sub> O+.....	.43		
					100.16

## SAN CRISTOBAL QUADRANGLE

A-H. Rocks collected by E. S. Larsen. Analyses by J. G. Fairchild, records C-954, C-474a, C-547, and C-614.

A. Hornblende-quartz latite from first ridge south of Powderhorn Gulch, at 10,900 feet. About 20 percent of phenocrysts, chiefly labradorite, some green-brown hornblende, in a groundmass clouded with hematite and carrying minute oligoclase laths in glass.

B. Quartz-bearing hornblende-pyroxene andesite from mesa between Red Mountain and Middle Creek, 4 miles north of Piedra Peak.

C. Biotite-pyroxene latite-andesite from west slope of Mineral Creek, near head, at an altitude of 11,400 feet.

D. Quartz latite with large phenocrysts from ridge south of Grassy Mountain, west of Lake San Cristobal, at an altitude of 10,400 feet.

E. Huerto andesite, 2 miles northwest of Cache Lake at top of hill, altitude 12,355 feet.

F. Latite of Alboroto quartz latite type from Texas Creek.

G. Piedra rhyolite from crest west of Bennett Creek.

H. Treasure Mountain quartz latite, saddle between Vete and Bear Creeks.

I. Alboroto quartz latite, canyon of Texas Creek. Collected by Whitman Cross. Contains phenocrysts of andesine-labradorite, quartz, orthoclase, hornblende, augite, biotite, and sphene in a groundmass of quartz and alkali feldspar. Apatite, zircon, and iron oxides are present. Mass analysis by W. T. Schaller, revised by J. G. Fairchild in 1925, record 2864.



	A	B	C	D	E	F	G	H	I
SiO <sub>2</sub> .....	66.28	57.56	58.73	66.18	53.65	66.51	74.07	69.07	66.39
Al <sub>2</sub> O <sub>3</sub> .....	16.14	15.06	15.73	14.41	16.68	15.58	13.38	14.98	15.45
Fe <sub>2</sub> O <sub>3</sub> .....	2.46	6.75	4.14	2.35	4.81	2.43	.97	3.06	2.50
FeO.....	1.11	1.59	2.85	1.26	4.48	1.38	.33	.30	1.13
MgO.....	.50	3.43	2.69	.90	2.77	1.03	Trace?	.12	.85
CaO.....	3.19	6.01	5.29	3.20	7.44	3.40	.76	1.79	3.71
Na <sub>2</sub> O.....	3.89	3.12	3.08	3.72	3.01	3.61	3.72	3.48	3.65
K <sub>2</sub> O.....	5.16	2.84	3.34	4.76	2.71	4.74	5.60	4.93	4.59
H <sub>2</sub> O.....	.18	.31	.76	.07	.99	.49	.18	.58	.66
H <sub>2</sub> O+.....	.65	.61	1.32	.60	.81	.61	.44	1.10	.56
TiO <sub>2</sub> .....	.60	1.50	1.10	1.20	1.80	.50	.20	.50	.50
ZrO <sub>2</sub> .....									.03
P <sub>2</sub> O <sub>5</sub> .....	.22	.38	.32	.13	.45	.20	Trace	.16	.36
CO <sub>2</sub> .....		.07		.94					None
SO <sub>3</sub> .....		.10							
S.....		None							.03
MnO.....		.09	.14	.06	.27				.06
BaO.....		.06							.07
SrO.....		.14							.02
Total.....	100.38	99.62	99.49	99.78	99.87	100.48	99.65	100.07	100.56

SAN JUAN REGION

Rocks collected by E. S. Larsen. See Bull. 843, 1935. Analyses by J. G. Fairchild: A-B, record 3293; C, C-726; D-G, C-804.

- A. Soda syenite from north flank of Mesa Angostulla, 6 miles east of Manassa.
- B. Diorite, same locality. Feldspars largely andesine, but some orthoclase and albite are present. Biotite, augite, and magnetite.
- C. Sheep Mountain andesite 0.5 mile west-southwest of bench mark in Carson Pass.
- D. Glassy matrix rhyolite from Valles Mountain, N. Mex.
- E. Spherulites enclosed in glassy matrix rhyolite from Valles Mountain, N. Mex.
- F. Andesite from east side of Boot Mountain, northeast corner of Creede quadrangle.
- G. Rhyolite from altitude of 9,170 feet in canyon 0.5 mile northeast of hill 10,315, which is midway between Old Woman Creek and west line of quadrangle.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	59.68	58.45	56.40	71.57	67.04	76.04	76.46
Al <sub>2</sub> O <sub>3</sub> .....	18.40	16.61	16.17	15.10	15.88	12.32	12.60
Fe <sub>2</sub> O <sub>3</sub> .....	2.54	2.74	4.19	1.04	3.05	.32	.51
FeO.....	1.05	3.44	4.30	.29	.77	.80	.51
MgO.....	1.14	2.58	3.55	.36	.75	.20	.36
CaO.....	4.24	4.66	7.07	1.19	2.37	.52	Trace
Na <sub>2</sub> O.....	6.40	4.16	3.22	3.88	3.86	3.51	4.60
K <sub>2</sub> O.....	4.42	4.66	2.79	5.80	5.48	6.64	4.32
H <sub>2</sub> O.....	Trace	.14	.51	.26	.23	.01	.06
H <sub>2</sub> O+.....	.36	.46	.47	.46	.53	.05	.84
TiO <sub>2</sub> .....	1.28	1.38	1.31	.15	.55	.10	.10
P <sub>2</sub> O <sub>5</sub> .....	.45	.51	.29	.06	.17	Trace	None
MnO.....	Trace	.08	.12				
Total.....	99.96	99.87	100.39	100.16	100.68	100.51	100.36

SPANISH PEAKS DISTRICT

Seven rocks collected by Adolph Knopf. Analyses by George Steiger, record D-266.

- A. Augite diorite porphyry from dike on Bear Creek. Contains large and abundant phenocrysts of labradorite and some augite in a groundmass of plagioclase, augite, and biotite, with minor quartz, magnetite, and apatite.
- B. Shonkinite porphyry from Walsen dike, at intersection with Walsenburg-Gardner road, Walsenburg quadrangle. Consists of phenocrysts of augite, biotite, and olivine in a groundmass of augite, biotite, and sanidine, with abundant magnetite.
- C. Shonkinite from dike near Walsenburg-La Veta road, Walsenburg quadrangle. Consists mainly of augite, biotite, olivine and sanidine, with some nosean (?) and abundant magnetite and apatite.
- D. Monchiquite from Unfug dike, south of Walsenburg, Walsenburg quadrangle. Contains abundant phenocrysts of olivine and augite in a groundmass of biotite, magnetite, apatite, analcite, plagioclase, and sanidine.



E. Granite porphyry, east flank of East Spanish Peak, Spanish Peaks quadrangle. A white porphyry crowded with phenocrysts of oligoclase and orthoclase and minor hornblende and biotite in a groundmass of feldspar and quartz.

F. Olivine essexite from Huerfano Butte, Walsenburg quadrangle. Consists of augite, biotite, olivine, and plagioclase, with minor magnetite, apatite, analcite, and titanite.

G. Pyroxene diorite from summit of West Spanish Peak, Spanish Peaks quadrangle. Consists of andesine, augite, hypersthene, biotite, and minor quartz, magnetite, and apatite.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	54.46	46.37	52.90	45.18	73.47	46.73	59.18
Al <sub>2</sub> O <sub>3</sub> .....	17.47	11.98	10.20	12.36	13.74	13.04	15.95
Fe <sub>2</sub> O <sub>3</sub> .....	4.25	5.05	3.61	4.44	1.15	3.62	3.00
FeO.....	2.83	5.16	4.44	5.72	.70	7.35	3.88
MgO.....	2.90	8.38	9.06	10.25	.35	9.66	2.74
CaO.....	5.91	9.33	6.91	10.37	1.24	10.22	4.73
Na <sub>2</sub> O.....	4.37	2.84	2.20	2.64	4.39	3.06	4.42
K <sub>2</sub> O.....	3.06	4.34	6.36	3.08	4.52	1.93	3.63
H <sub>2</sub> O.....	.53	.71	.14	.27	.22	.33	.13
H <sub>2</sub> O+.....	1.61	2.17	1.73	2.89	.18	1.50	.56
TiO <sub>2</sub> .....	1.48	1.80	1.17	1.63	.34	1.76	1.36
CO <sub>2</sub> .....	.37	.24	None	Trace	None	Trace	.16
P <sub>2</sub> O <sub>5</sub> .....	.69	1.34	.63	1.02	.08	.76	.52
MnO.....	.08	.10	.11	.11	.06	.16	.10
BaO.....	-----	-----	.07	.17	-----	-----	-----
Cl.....	-----	-----	None	.10	-----	-----	-----
S.....	-----	-----	None	None	-----	-----	-----
SO <sub>3</sub> .....	-----	-----	.07	.25	-----	-----	-----
ZrO <sub>2</sub> .....	-----	-----	None	-----	-----	-----	-----
Less O=Cl <sub>2</sub> .....	100.01	99.81	99.60	100.48	100.44	100.12	100.36
	-----	-----	-----	.03	-----	-----	-----
	-----	-----	-----	100.45	-----	-----	-----

## SUMMITVILLE QUADRANGLE

A. Tabular feldspar-pyroxene andesite from Carnero Canyon, collected by E. S. Larsen. Analyses A and B by R. K. Bailey, record C-474-b. Phenocrysts of calcic labradorite 20 percent, augite 10 percent, hypersthene a little; in the groundmass, andesine 40 percent, orthoclase 10 percent, quartz 6 percent, augite 5 percent, magnetite 7 percent.

B. Similar rock from west slope of Summit Peak, at an altitude of 12,800 feet. Carries somewhat more quartz and alkali feldspar and less mafites.

C. Gabbro-diorite southeast of Buckle Lake, at an altitude of 10,500 feet. Analyses C to F by J. G. Fairchild, record C-493.

D. Gabbro-diorite from Gold Creek at an altitude of 11,400 feet on northwest slope of peak, 400 feet from summit.

E. Basaltic pyroxene andesite near head of the Alamosa River and 1 mile southeast of Summit Peak.

F. Latite from west slope of Treasure Mountain.

G. Treasure Mountain quartz latite from northwest slope of Sheep Mountain. Analysis by J. G. Fairchild, record C-614.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	55.86	60.21	55.77	55.47	57.76	67.03	70.80
Al <sub>2</sub> O <sub>3</sub> .....	13.71	15.34	15.04	16.86	16.24	15.71	14.48
Fe <sub>2</sub> O <sub>3</sub> .....	5.55	3.23	3.77	4.34	3.87	2.74	2.14
FeO.....	3.67	3.10	4.38	3.33	3.54	.69	.16
MgO.....	4.26	2.57	4.44	2.82	2.76	.60	.14
CaO.....	6.34	4.95	6.58	6.20	6.45	2.15	1.24
Na <sub>2</sub> O.....	3.40	4.06	2.85	3.34	3.31	3.94	3.24
K <sub>2</sub> O.....	2.94	3.54	2.82	2.82	2.59	4.72	6.58
H <sub>2</sub> O.....	.99	.43	.70	.63	.80	.47	.13
H <sub>2</sub> O+.....	.60	.83	.58	.86	.72	.75	.57
TiO <sub>2</sub> .....	1.66	1.05	1.14	1.33	1.00	.64	.45
P <sub>2</sub> O <sub>5</sub> .....	.82	.74	.28	.35	.35	.20	.11
ZrO <sub>2</sub> .....	-----	-----	Trace	-----	-----	-----	-----
CO <sub>2</sub> .....	-----	-----	.89	1.45	None	Trace?	-----
S.....	-----	-----	.03	-----	-----	-----	-----
MnO.....	-----	-----	.07	Trace	.11	Trace	-----
BaO.....	-----	-----	.06	.13	-----	-----	-----
SrO.....	-----	-----	.13	.04	-----	-----	-----
	99.80	100.05	99.53	99.97	99.50	99.64	100.04



UNCOMPAGHRE QUADRANGLE

Rocks collected by E. S. Larsen. Analyses by George Steiger, record 2982.

A. Biotite rock associated with pyroxenite, collected on the north side of Beaver Creek about half a mile southwest of the forks. Rather coarse-grained and made up chiefly of biotite with considerable apatite.

B. "Iron ore", variety of pyroxenite. North side of gully passing bench mark 8104, just below 8,300-foot contour. Rather coarse-grained rock made up of about equal amounts of magnetite and perovskite with a little mica, apatite, and pyroxene.

C. Garnet-nepheline rock. South of Beaver Creek and south of the mouth of North Beaver Creek, at an altitude of 8,540 feet. Coarse-grained, about equal quantities of garnet (schorlomite) and nepheline with little pyroxene and apatite.

D. Uncompahgrite. Between Beaver and North Beaver Creeks. Medium-grained rock made up about half of melilite with considerable pyroxene, biotite, apatite, magnetite, perovskite, and amphibole.

E. Altered uncompahgrite. South of Beaver Creek, just south of hill 8600. Contains a little pyroxene in altered melilite. The melilite is altered to garnet, diopside, and vesuvianite.

F. Titanite-rich pyroxenite. South of North Beaver Creek about a mile above its junction with Beaver Creek. Made up of nearly equal quantities of pyroxene and titanite with a little apatite and altered nepheline.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	22.02	0.99	35.82	38.04	40.01	43.50
Al <sub>2</sub> O <sub>3</sub> .....	10.80	2.80	18.04	6.34	5.41	3.97
Fe <sub>2</sub> O <sub>3</sub> .....	8.82	24.03	9.92	8.45	7.12	3.42
FeO.....	6.44	14.26	2.02	5.90	1.08	4.41
MgO.....	13.02	1.90	.77	7.81	8.89	8.12
CaO.....	13.58	19.86	17.18	27.19	30.99	24.69
Na <sub>2</sub> O.....	.70	None	6.30	2.16	.60	1.55
K <sub>2</sub> O.....	4.75	None	3.04	.12	None	.14
H <sub>2</sub> O.....	1.51	.39	.42	.22	.52	.34
H <sub>2</sub> O+.....	2.70	.37	.82	.48	2.00	.58
TiO <sub>2</sub> .....	8.79	35.05	4.61	1.98	1.00	5.35
ZrO <sub>2</sub> .....	None	None	.05	None	None	None
CO <sub>2</sub> .....	None	.08	.48	.30	1.51	.66
P <sub>2</sub> O <sub>5</sub> .....	6.35	.58	.08	.24	.88	3.11
S.....	.02	.01	.03	.02	.06	.03
F.....	.07					
Cl.....	.04					
Cr <sub>2</sub> O <sub>3</sub> .....	.01	None	None	None	None	None
V <sub>2</sub> O <sub>5</sub> .....	.03	.06	.05	None	None	None
NiO.....	.02	None	None	None	None	None
MnO.....	.15	.24	.19	.23	.11	.19
BaO.....	.48	None	None	None	None	None
SrO.....	.17	.06	None	.26	.21	.13
Less O.....	100.47	100.68	99.82	99.74	100.39	100.19
	.04					
	100.43					
Specific gravity.....	3.386	4.335	3.151	3.257	3.165	3.298

G-K. Rocks collected by E. S. Larsen.

G. Shonkinite from Wildcat Gulch, altitude 8,100 feet. Orthoclase, augite, olivine, biotite, magnetite, apatite.

H. Augite-microcline syenite, south side of Wildcat Gulch, altitude 8,300 feet. Microperthite, augite, biotite, amphibole, magnetite, apatite, little quartz, titanite, zircon, and rutile. These two rocks described by J. Fred Hunter in Bulletin 777, 1925.

I. Soda syenite, north fork of Beaver Creek. About 90 percent microperthite, 10 percent aegirine-diopside, and minor apatite, titanite, zircon, and fluorite. Analyses G-I by George Steiger, record 2900.

J. Alteration product of melilite, Iron Hill. Analysis by George Steiger, record 2909.

K. Alboroto quartz latite from base of the formation, northwest part of quadrangle. Analysis by J. G. Fairchild, record C-954.



	G	H	I	J	K
SiO <sub>2</sub> .....	50.86	54.99	65.08	33.70	72.94
Al <sub>2</sub> O <sub>3</sub> .....	11.14	12.98	16.65	29.40	13.06
Fe <sub>2</sub> O <sub>3</sub> .....	2.93	3.13	2.01	.....	.72
FeO.....	5.21	3.92	1.08	.....	1.45
MgO.....	11.26	5.50	.....	None	.21
CaO.....	6.97	5.67	1.49	4.18	1.08
Na <sub>2</sub> O.....	1.73	2.83	7.31	18.52	3.70
K <sub>2</sub> O.....	5.85	7.08	5.14	1.45	0.15
H <sub>2</sub> O.....	.64	.41	.32	.72	.39
H <sub>2</sub> O+.....	.95	.58	.30	4.24	.69
TiO <sub>2</sub> .....	.84	.99	.20	.07	.25
CO <sub>2</sub> .....	.02	.04	.03	.....	.....
P <sub>2</sub> O <sub>5</sub> .....	None	None	None	3.18	.....
S.....	.79	1.00	.04	.....	.05
Cr <sub>2</sub> O <sub>3</sub> .....	.02	.05	.02	.....	.....
V <sub>2</sub> O <sub>5</sub> .....	.11	.01	None	.....	.....
NiO.....	None	None	None	.....	.....
MnO.....	.04	.04	None	.....	.....
BaO.....	.13	.13	.13	.....	.....
SrO.....	.31	.47	.03	.....	.....
SO <sub>3</sub> .....	.22	.17	.03	.08	.....
Cl.....	.....	.....	.....	4.65	.....
	.....	.....	.....	None	.....
	100.02	99.99	100.07	100.19	100.69
Specific gravity.....	.....	.....	.....	2.443	.....

## MISCELLANEOUS ROCKS

Five intrusives, Eocene, from Gunnison County, collected by J. W. Vanderwilt. Analysis A by J. G. Fairchild, B-E by Charles Milton, record D-172.

A. Granite from Treasure Mountain. Orthoclase (perthitic), quartz, biotite, a little magnetite, apatite, and titanite.

B. Intrusive from Snowmass Mountain. Orthoclase, oligoclase-andesine, quartz, brown biotite, calcite; minor green hornblende, magnetite, apatite, titanite, sericite, clinozoisite, chlorite replacing biotite, zircon, a grain or two of strongly pleochroic allanite, and possibly leucoxene (dark-brown semiopaque alteration product).

C. Intrusive from Snowmass Mountain. Orthoclase, oligoclase-andesine, quartz, brown biotite, green hornblende, magnetite, minor apatite, titanite, sericite, zircon.

D. Intrusive from Snowmass Mountain. Minerals similar to B. Much calcite replacing mafic minerals. Feldspars albitized.

E. Similar to C.

	A	B	C	D	E
SiO <sub>2</sub> .....	76.46	66.19	59.68	60.67	56.83
Al <sub>2</sub> O <sub>3</sub> .....	12.58	15.72	16.31	16.76	16.67
Fe <sub>2</sub> O <sub>3</sub> .....	.52	2.36	4.11	1.52	4.62
FeO.....	.59	2.13	4.11	3.64	4.48
MgO.....	.13	1.26	2.51	1.98	2.75
CaO.....	.52	2.58	6.36	2.96	6.45
Na <sub>2</sub> O.....	3.78	3.87	3.42	6.48	3.56
K <sub>2</sub> O.....	5.45	3.60	2.12	.60	1.82
H <sub>2</sub> O.....	None	.93	.05	1.98	.88
H <sub>2</sub> O+.....	.48				
TiO <sub>2</sub> .....	.05	.49	.60	.50	.58
CO <sub>2</sub> .....	Trace	.20	.....	2.03	.07
P <sub>2</sub> O <sub>5</sub> .....	.06	.40	.42	.40	.59
MnO.....	.04	.02	.17	.04	.21
BaO.....	.....	.21	.18	.06	.09
	100.66	99.96	100.69	99.62	99.60

F. Dike from Fortification Rocks, sec. 12, T. 9 N., R. 91 W., 1 mile north of Craig, submitted by C. S. Ross. Olivine, augite, and biotite in glass. Analysis by George Steiger, record C-600.

G. Interior of dike.

H. Analcite basalt from top of Breeze Mountain, near Craig. Analyses G and H by George Steiger, record C-677.

I-K. Three granites from Climax, collected by J. W. Vanderwilt and described in Bull. 846-C, 1933. Analyses by J. G. Fairchild, record C-1129.



	F	G	H	I	J	K
SiO <sub>2</sub> .....	53.48	52.83	48.31	80.78	78.62	70.83
Al <sub>2</sub> O <sub>3</sub> .....	11.54	11.87	14.32	9.26	10.80	14.41
Fe <sub>2</sub> O <sub>3</sub> .....	2.84	3.44	3.48	Trace	.05	.35
FeO.....	3.50	3.03	6.13	1.34	1.13	2.94
MgO.....	8.14	8.38	7.72	.10	.05	.56
CaO.....	5.45	6.64	9.12	.10	.05	.64
Na <sub>2</sub> O.....	3.38	2.68	3.19	.31	.76	2.44
K <sub>2</sub> O.....	3.82	4.95	2.10	7.68	8.11	6.21
H <sub>2</sub> O.....	.47	1.35	.79	.01	.10	.04
H <sub>2</sub> O+.....	3.68	1.43	2.75	.46	.43	1.34
TiO <sub>2</sub> .....	1.47	1.42	1.38	Trace	.04	.24
P <sub>2</sub> O <sub>5</sub> .....	.95	.87	.64	.08	.10	.15
S.....	.09	.....	.....	.03	.06	.01
Cr <sub>2</sub> O <sub>3</sub> .....	.05	.....	.....	.....	.....	.....
MnO.....	.08	.06	.11	.....	.....	.....
BaO.....	.43	.....	.....	.01	.03	.02
SrO.....	.23	.....	.....	.....	.....	.....
CO <sub>2</sub> .....	None	.88	None	.....	.....	.....
ZrO <sub>2</sub> .....	None	.....	.....	.....	.....	.....
Cl.....	.....	.....	.....	.04	.04	.04
F.....	.....	.....	.....	.05	None	None
Mo.....	.....	.....	.....	.12	.10	None
.....	99.60	99.83	100.04	100.37	100.47	100.22
Specific gravity:	.....	.....	.....	.....	.....	.....
Lump.....	.....	.....	.....	2.25	2.23	2.52
Particles.....	.....	.....	.....	2.57	2.60	2.68

L-R. Volcanic rocks collected by E. N. Goddard and T. S. Lovering, mainly in Boulder County.

L. Rhyolite from Lawson arkose 2.8 miles S. 45° E. of Castle Rock, Douglas County. Feldspar, biotite, and quartz phenocrysts in a pink felsitic ground mass. Sanidine, a little oligoclase and microcline. Analysis by R. C. Wells, record D-405.

M. Biotite latite intrusive breccia from the Mud vein in the lower tunnel of the Yellow Pine mine, 5¼ miles northwest of Boulder. Microlites of oligoclase-andesine with minute shreds of muscovite and a glassy ground mass.

N. Biotite monzonite from the same locality as B. Small phenocrysts of feldspar, biotite, and hornblende in a dark-gray ground mass.

O. Quartz monzonite porphyry from the breast of Skunk tunnel on the south slope of Porphyry Mountain, Jamestown. Analyses M-O by J. G. Fairchild, record D-475.

P. Granodiorite 4,500 feet S. 25° W. from Jamestown. Plagioclase, orthoclase, quartz, hornblende, with magnetite, titanite, apatite, zircon, calcite, chlorite, epidote, and kaolinite in minor amounts.

Q. Granite, South St. Vrain Creek, 3½ miles N. 50° W. of Jamestown. Microcline, quartz, orthoclase, biotite, muscovite, with magnetite, apatite, zircon.

R. Biotite schist from old mill site, 0.5 mile southeast of Springdale. Quartz, biotite, muscovite, oligoclase, microcline, sillimanite, with apatite, zircon, calcite, rutile, and sericite. Analyses P-R by Charles Milton, record D-375.

	L	M	N	O	P	Q	R
SiO <sub>2</sub> .....	82.16	68.23	57.65	64.14	57.37	68.33	62.04
Al <sub>2</sub> O <sub>3</sub> .....	8.27	13.59	15.64	17.14	16.12	14.77	17.43
Fe <sub>2</sub> O <sub>3</sub> .....	.75	1.95	3.08	1.09	4.32	1.28	.95
FeO.....	.16	.98	2.78	1.04	3.47	2.68	7.12
MgO.....	.15	1.39	1.17	.41	2.89	.80	2.07
CaO.....	.59	1.11	4.33	2.19	5.74	2.30	.52
Na <sub>2</sub> O.....	2.19	.18	3.80	4.91	3.00	2.72	.68
K <sub>2</sub> O.....	3.94	3.74	4.28	5.41	4.40	5.04	4.10
Li, Rb.....	None	.....	.....	.....	.....	.....	.....
H <sub>2</sub> O.....	.89	3.59	1.44	.62	.18	.01	.12
H <sub>2</sub> O+.....	1.04	3.48	1.68	1.44	1.11	1.07	2.97
TiO <sub>2</sub> .....	.28	.43	.75	.13	1.06	.77	1.16
CO <sub>2</sub> .....	None	1.20	3.31	1.45	.12	.05	.88
P <sub>2</sub> O <sub>5</sub> .....	.02	.16	.45	.05	.20	.11	.05
MnO.....	.034	.05	.11	.03	.09	.04	.06
F.....	.....	.....	.....	.15	.18	.20	.17
BaO.....	.....	.03	.11	.13	.10	.14	.09
WO <sub>3</sub> .....	.....	None	None	.....	.....	.....	.....
.....	100.474	100.11	100.58	100.33	100.35	100.31	100.41
Less O=F <sub>2</sub> .....	.....	.....	.....	.06	.07	.08	.07
.....	.....	.....	.....	100.27	100.28	100.24	100.34



CONNECTICUT  
GUILFORD QUADRANGLE

Eight rocks submitted by Arthur Keith. Analysis A by R. K. Bailey, B-H by J. G. Fairchild, record 3273.

- A. Haddam granite gneiss.  
B. Same, contact.  
C. Hornblende gneiss.  
D. Stony Creek granite gneiss.  
E. Conglomerate.  
F. Metaconglomerate.  
G. Quartzitic gneiss.  
H. Amphibolite.

	A	B	C	D	E	F	G	H
SiO <sub>2</sub> .....	72.73	74.14	66.91	73.56	59.20	67.56	76.90	47.90
Al <sub>2</sub> O <sub>3</sub> .....	15.53	12.07	15.47	13.30	19.18	15.00	12.10	18.32
Fe <sub>2</sub> O <sub>3</sub> .....	.83	2.10	1.57	.91	Trace	1.43	1.21	1.20
FeO.....	1.12	2.48	3.74	2.60	6.51	4.64	1.37	7.48
MgO.....	.72	1.05	1.80	.81	2.45	2.34	1.86	9.19
CaO.....	4.31	3.88	4.78	1.88	1.05	4.76	.40	11.64
K <sub>2</sub> O.....	.49	.39	1.29	1.94	5.41	1.54	Trace	1.13
Na <sub>2</sub> O.....	2.17	2.53	1.70	2.44	1.61	1.70	5.30	2.35
H <sub>2</sub> O.....	.06	.07	.03	.05	.45	.02	.02	.02
H <sub>2</sub> O+.....	1.19	1.11	1.16	.92	1.79	.50	.50	.49
TiO <sub>2</sub> .....	.16	.34	.54	.59	1.25	.40	.20	.48
ZrO <sub>2</sub> .....	None	.02	None	.05	.05	None	None	None
P <sub>2</sub> O <sub>5</sub> .....	.16	.20	.26	.20	.21	.08	Trace	.02
Cl.....	None	None	.05	.03	Trace	Trace	Trace	Trace
F.....	None	None	None	Trace	None	None	Trace	None
MnO.....	.05	Trace	.14	.04	.25	Trace	Trace	.18
BaO.....	None	None	.10	.03	.17	Trace	Trace	Trace
SrO.....	Trace	None	None	Trace	None	None	Trace	None
Li <sub>2</sub> O.....	Trace	Trace	Trace	Trace	.40	Trace	Trace	None
Cr <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	None	None	None	.06
S.....	None	None	None	None	None	None	None	None
	99.52	100.38	99.54	99.35	99.99	99.97	99.86	100.46

MISCELLANEOUS ROCKS

Pegmatites described by F. J. Katz in Mineral Resources for 1915, pt. 2, pp. 43-55, 1917. Analyses by R. C. Wells, record 3135.

- A. Howe quarry, South Glastonbury, east wall. Some muscovite and quartz.  
B. Strickland quarry, Portland, sampled across the dike.  
C. Eureka quarries, Middle Haddam.  
D. Gildersleeve prospect, Portland.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	72.42	71.00	75.20	74.42	K <sub>2</sub> O.....	6.24	7.65	4.55	3.49
Al <sub>2</sub> O <sub>3</sub> .....	15.88	16.06	13.81	15.13	H <sub>2</sub> O (total).....	.46	.34	.45	.39
Fe <sub>2</sub> O <sub>3</sub> (total Fe).....	.54	.63	.86	.52	TiO <sub>2</sub> .....	.05	.04	.17	.02
MgO.....	Trace	.02	None	None					
CaO.....	.65	.32	.62	.44		99.98	99.81	99.71	99.81
Na <sub>2</sub> O.....	3.74	3.75	4.05	5.40					

DOMINICAN REPUBLIC AND VIRGIN ISLANDS

Five specimens related to andesite, submitted by T. W. Vaughan. Analyses by R. C. Wells, record C-300.

- A. Western foothills of Loma de los Palos, Province of Santo Domingo.  
B. Loma Pegado, near Maimón, Province of La Vega. A and B collected by C. P. Ross.  
C. Andesite hill opposite Arroyo Salado, left bank of Rio Yaque del Sur, Province of Azua. Collected by D. D. Condit and C. P. Ross.  
D. Island of Vieques, Virgin Islands, western edge of Mosquito. Collected by T. W. Vaughan.  
E. Culebra Island, northwest peninsula, west of southwest corner of Flamingo Bay, east side of divide, on road to abandoned radio station.



	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> -----	51.58	42.82	60.31	61.22	58.47	CO <sub>2</sub> -----	Trace	None	0.21	None	Trace
Al <sub>2</sub> O <sub>3</sub> -----	15.15	14.41	15.57	16.47	15.21	P <sub>2</sub> O <sub>5</sub> -----	0.03	0.18	.23	None	0.22
Fe <sub>2</sub> O <sub>3</sub> -----	3.07	1.53	3.41	2.97	2.65	S-----	None	None	.03	None	Trace
FeO-----	8.68	10.13	1.92	3.47	5.88	Cr <sub>2</sub> O <sub>3</sub> -----	.01	.02	-----	-----	-----
MgO-----	5.76	8.34	2.72	2.54	2.55	V <sub>2</sub> O <sub>5</sub> -----	.06	.06	-----	-----	-----
CaO-----	10.08	11.95	5.78	6.18	3.71	MnO-----	.17	.11	.05	0.13	.11
Na <sub>2</sub> O-----	1.75	2.76	4.50	3.81	4.82	BaO-----	None	None	.43	.04	.10
K <sub>2</sub> O-----	.17	.27	3.34	1.77	2.55	SrO-----	Trace	None	.06	.06	.09
H <sub>2</sub> O-----	.32	1.37	.28	.19	.37	Rare earths--	-----	None	None	-----	None
H <sub>2</sub> O+-----	2.86	4.70	.50	1.12	1.94						
TiO <sub>2</sub> -----	.71	1.87	.57	.48	1.09						
ZrO <sub>2</sub> -----	None	None	None	None	Trace		100.40	100.52	99.91	100.45	99.76

GEORGIA

Sericite schist, Jasper. Submitted by P. S. Smith. Analysis by R. K. Bailey, record 3114.

SiO <sub>2</sub> -----	52.96	MgO-----	1.21	MnO-----	Trace
Al <sub>2</sub> O <sub>3</sub> -----	29.16	K <sub>2</sub> O-----	9.82	CO <sub>2</sub> -----	None
Fe <sub>2</sub> O <sub>3</sub> -----	2.86	Na <sub>2</sub> O-----	1.15		
FeO-----	.33	H <sub>2</sub> O-----	2.27		100.16
CaO-----	.40				

HAWAII

A-D. Four lavas collected by W. O. Clark, Pahala, Kau. Analyses by R. K. Bailey, record C-398.

A. Post-Pahala basalt. Pahoehoe on floor of Makanao Valley at southwest end of Pakua graben fault, at an altitude of 1,400 feet.

B. Pre-Pahala basalt. Lava overflowing ash bed at Pahala water-supply spring, in the east face of Kaumaikoeahu Peak, at an altitude of 2,780 feet. (This is called "Kaumaikoeahu Spring" on label with specimen. Cross.)

C. Pre-Pahala basalt. Makai slope of Clover Hill, at an altitude of 1,250 feet, N. 30° W. from Naalehu. (The name "Kapuna or Kapuua" is given in parentheses after "Clover Hill" on label with specimen. Cross.)

D. Lava covering a considerable area in the Pahala basalt on the slopes back of Naalehu. Specimen from gulch N. 10° W. of Naalehu, at an altitude of 1,100 feet.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> -----	45.97	48.60	49.24	49.24	H <sub>2</sub> O-----	0.04	0.06	1.15	0.47
Al <sub>2</sub> O <sub>3</sub> -----	5.98	10.75	12.72	13.51	H <sub>2</sub> O+-----	.64	.22	1.57	.70
Fe <sub>2</sub> O <sub>3</sub> -----	5.86	3.92	4.27	3.86	TiO <sub>2</sub> -----	1.75	3.37	3.40	3.70
FeO-----	7.39	9.38	8.44	8.88	MnO-----	.11	.05	.10	.12
MgO-----	23.55	9.80	7.10	5.90	P <sub>2</sub> O <sub>5</sub> -----	.21	.18	.08	.17
CaO-----	6.47	10.38	9.74	10.44	CO <sub>2</sub> -----	None	None	None	None
Na <sub>2</sub> O-----	1.50	2.54	1.87	2.40					
K <sub>2</sub> O-----	.42	.34	.28	.46		99.89	99.59	99.96	99.85

E-L. Lavas collected by H. A. Powers. Analyses E-J by J. J. Fahey, K by L. T. Richardson, L by R. E. Stevens, record D-89.

E. Oiaa. Mauna Loa aa flow, road cut on Government road at south boundary of Waiakea National Forest.

F. Reservoir, Mauna Loa pahoehoe flow, from reservoir at Pihoonua.

G. Quarry, Kilauea pahoehoe flow, National Park quarry, on Hilo road 1 mile from observatory.

H. Halemaumau, splash from lava lake, 1917.

I. Halemaumau, splash from lava lake during eruption of Alika flow from Mauna Loa, 1919.

J. Halemaumau, pahoehoe flow from northeast edge of floor of Kilauea Crater, 1919.

K. Halemaumau, pahoehoe flow from south edge of floor of Kilauea Crater, 1921.

L. Halemaumau, scoria from lava fountain, July 1929.



	E	F	G	H	I	J	K	L
SiO <sub>2</sub> .....	50.41	52.14	51.35	50.14	50.37	50.52	50.85	51.00
Al <sub>2</sub> O <sub>3</sub> .....	12.37	13.60	13.36	13.93	14.20	13.85	15.30	13.03
Fe <sub>2</sub> O <sub>3</sub> .....	1.94	2.31	1.32	.57	1.28	.98	.28	1.83
FeO.....	9.56	8.50	9.85	10.07	10.10	9.77	10.42	10.02
MgO.....	7.68	7.26	7.62	8.25	7.75	7.07	7.80	6.76
CaO.....	12.56	10.14	10.74	11.17	11.24	11.33	11.45	12.40
Na <sub>2</sub> O.....	1.68	2.02	1.93	1.29	2.20	1.51	.70	2.02
K <sub>2</sub> O.....	.40	.48	.50	.41	.56	.47	.58	.73
H <sub>2</sub> O.....	None	.06	None	None	None	None	Trace	None
H <sub>2</sub> O+.....	.22	.16	.29	.03	.06	.04	.18	.35
TiO <sub>2</sub> .....	2.26	2.20	2.50	3.20	2.33	3.63	1.55	2.33
P <sub>2</sub> O <sub>5</sub> .....	.57	.29	.28	.23	.02	.22	.22	.14
Cr <sub>2</sub> O <sub>3</sub> .....	.05	.02	.03	.07	.05	.06	.05	1.08
NiO.....	.004	.005	.025	.002	.008	.001	>.002	Trace
MnO.....	.06	.07	.67	.06	.14	.14	.10	.18
	99.76	99.55	99.86	99.42	100.30	99.59	99.48	100.79

<sup>1</sup> Quantity of sample insufficient.

M-S. Seven rocks from island of Hawaii, collected by C. K. Wentworth. Analyses M-O by J. G. Fairchild; P, Q by J. J. Fahey; R, S by Charles Milton, record D-128.

M. From Ka Lae shore about 0.5 mile east of lighthouse.

N. Red tuff from Ninole basalt from altitude of about 850 feet, a few rods north of Kepue, Hilea.

O. Yellowish-brown tuff from altitude of 5,175 feet at Aukaiakeakua Gulch, southeast of Waikii.

P. Red basalt tuff from altitude of about 3,500 feet in Kemole Gulch.

Q. Yellow tuff beneath lava flow at altitude of 2,900 feet in Popoo Gulch, north of Keamuku.

R. Yellow tuff from altitude of about 600 feet in face of Puu Kapukapu, 0.5 mile east of summit.

S. Red palagonite tuff 5 feet below top of road cut 0.25 mile south of Pepeekeo.

	M	N	O	P	Q	R	S
SiO <sub>2</sub> .....	45.34	33.33	37.16	50.73	55.58	46.03	3.39
Al <sub>2</sub> O <sub>3</sub> .....	12.56	16.36	18.94	19.06	19.13	13.38	31.72
Fe <sub>2</sub> O <sub>3</sub> .....	12.20	16.32	7.37	7.48	6.40	9.28	24.90
FeO.....	1.14	.54	5.93	1.03	.50	4.22	.84
MgO.....	2.72	2.36	3.72	1.55	.52	3.45	.12
CaO.....	2.10	.82	5.58	1.92	.44	5.67	.03
Na <sub>2</sub> O.....	2.44	.12	2.67	1.79	4.59	1.04	.44
K <sub>2</sub> O.....	1.27	.04	1.00	1.98	2.84	.38	.30
H <sub>2</sub> O.....	7.02	14.20	6.51	5.14	2.74	6.05	8.22
H <sub>2</sub> O+.....	9.20	11.94	6.33	6.60	5.58	6.62	24.27
TiO <sub>2</sub> .....	3.54	3.92	3.51	1.79	1.46	2.93	5.01
CO <sub>2</sub> .....	-----	-----	.10	-----	-----	-----	-----
P <sub>2</sub> O <sub>5</sub> .....	.12	.10	1.02	.13	.10	.58	1.15
MnO.....	.12	.20	.12	.11	.31	.34	.13
Organic matter.....	-----	-----	Trace	-----	-----	-----	-----
	99.77	100.25	99.96	99.31	100.19	99.97	100.52

### IDAHO

#### CASTO QUADRANGLE

Volcanic rocks collected by C. P. Ross and described in Bull. 854, 1935. Analyses by J. G. Fairchild, records C-983 and C-1003.

A. Pink granite from Loon Creek, of post-Eocene age. A doubtful trace of cassiterite may be present.

B. Gray granite, Idaho batholith, 1 mile above mouth of Mayfield Creek.

C. Spherulitic rhyolite, near Sleeping Deer Park.

D. Yankee Fork rhyolite member of Challis volcanics, head of Salmon River.

E. Tuff below Yankee Fork rhyolite member.

F. Typical lava, Mayfield Peak. F-J, partial analyses only.

G. Above Forge Creek.

H. Trachyte. East of Mayfield railroad.

I. Lava near Meyers Cove.

J. Lava at top of measured section above Merino Creek.



	A	B	C	D	E	F	G	H	I	J
SiO <sub>2</sub> -----	71.85	69.15	73.74	76.62	73.70	57.46	63.92	76.81	67.90	62.12
Al <sub>2</sub> O <sub>3</sub> -----	13.55	14.49	12.29	11.04	13.58	14.40	14.02	-----	-----	14.62
Fe <sub>2</sub> O <sub>3</sub> -----	.67	.93	1.31	1.14	1.60	5.40	6.07	-----	-----	5.81
FeO-----	2.66	2.62	1.25	1.40	.66	-----	-----	-----	-----	-----
MgO-----	.09	.41	.39	.05	.09	-----	-----	-----	-----	-----
CaO-----	1.00	2.14	.38	.06	.20	-----	-----	-----	-----	-----
Na <sub>2</sub> O-----	3.53	3.84	1.91	1.70	.91	3.58	3.44	3.63	3.30	2.69
K <sub>2</sub> O-----	5.89	3.98	5.17	6.86	5.02	3.33	4.36	5.51	5.14	3.91
H <sub>2</sub> O-----	.05	.20	.86	.20	.85	-----	-----	-----	-----	-----
H <sub>2</sub> O+-----	.58	1.47	2.06	.78	3.53	-----	-----	-----	-----	-----
TiO <sub>2</sub> -----	.20	.30	.20	.12	.12	.30	.95	-----	-----	.70
P <sub>2</sub> O <sub>5</sub> -----	.02	.10	-----	-----	-----	-----	-----	-----	-----	-----
	100.09	99.63	99.56	99.97	100.26	-----	-----	-----	-----	-----

EDWARDSBURG DISTRICT

Seven rocks collected by P. J. Shenon and analyzed by J. G. Fairchild, record D-423.

A. Rhyolite, 600 feet south and 35 feet west from center of Crater Lake, Profile Gap. Plagioclase (Ab<sub>92</sub>), quartz, orthoclase, chlorite and calcite, sericite, a little apatite.

B. Quartz diorite, about 250 feet N. 35° W. of Big Creek Point, Profile Gap. Plagioclase (Ab<sub>63</sub>), orthoclase, quartz, biotite, epidote, chlorite, sericite, apatite, magnetite.

C. Kersantite (Rosenbusch), 390 feet N. 18° W. from southwest corner of Glasgow claim corner, Profile Gap. Plagioclase (Ab<sub>70</sub>), biotite, quartz, orthoclase, calcite, chlorite, epidote, magnetite, apatite.

D. Quartz diorite, 300 feet N. 10° E. from southwest corner Glasgow claim, Profile Gap. Plagioclase (Ab<sub>65</sub>), quartz, calcite, chlorite, sericite, epidote, leucoxene, magnetite, apatite.

E. Granodiorite, 3,250 feet west of Red Metal Cabin, Profile Gap. Plagioclase (Ab<sub>67</sub>), orthoclase, quartz, biotite, hornblende, epidote, chlorite, magnetite, zircon, apatite.

F. Quartz latite porphyry from sharp point, 2,150 feet S. 85° W. from Red Metal Cabin. Plagioclase (Ab<sub>60</sub>), quartz, orthoclase, biotite, epidote and chlorite in biotite, calcite, apatite, zircon, magnetite.

G. Kersantite, 2,200 feet S. 88° W. from New Glasgow Cabin, Profile Gap. Plagioclase (Ab<sub>55</sub>), quartz, biotite, calcite, magnetite.

	A	B	C	D	E	F	G
SiO <sub>2</sub> -----	72.65	67.17	55.03	46.46	68.76	68.81	45.94
Al <sub>2</sub> O <sub>3</sub> -----	13.79	15.80	14.43	13.27	16.23	14.82	14.15
Fe <sub>2</sub> O <sub>3</sub> -----	.30	.70	4.20	2.60	.30	.75	2.80
FeO-----	1.80	2.79	3.69	7.20	2.21	2.34	6.21
MgO-----	.35	1.52	3.59	7.32	1.16	.90	5.79
CaO-----	.53	3.79	5.25	8.20	3.31	2.36	7.48
Na <sub>2</sub> O-----	3.31	3.54	3.20	1.68	3.87	3.45	2.52
K <sub>2</sub> O-----	5.22	2.75	2.71	1.71	2.71	4.55	2.24
H <sub>2</sub> O-----	None	.14	.65	.41	.04	.06	.46
H <sub>2</sub> O+-----	1.27	.86	1.96	3.25	.62	.94	.82
TiO <sub>2</sub> -----	.12	.64	2.00	1.50	.47	.45	1.80
CO <sub>2</sub> -----	.67	.05	1.92	5.50	.05	.19	9.64
P <sub>2</sub> O <sub>5</sub> -----	.04	.17	.79	.25	.09	.09	.19
MnO-----	.02	.06	.11	.20	.05	.07	.13
FeS <sub>2</sub> -----	-----	-----	-----	.37	-----	-----	-----
	100.07	99.98	99.53	99.92	99.87	99.78	100.17

PEND OREILLE DISTRICT

A-C. Three granodiorites collected by J. L. Gillson and described in Jour. Geology, vol. 35, p. 1, 1927. Analyses by George Steiger, record C-685. All these rocks consist of plagioclase, quartz, microcline, biotite, and hornblende, with minor apatite, magnetite, ilmenite, zircon, titanite, allanite, and rutile.

A. Bayview, composite sample.

B. Packsaddle Mountain.

C. Granite Creek.



	A	B	C		A	B	C
SiO <sub>2</sub> -----	62.62	66.40	65.61	H <sub>2</sub> O-----	0.20	0.20	0.32
Al <sub>2</sub> O <sub>3</sub> -----	15.63	14.40	16.10	H <sub>2</sub> O+-----	1.27	1.07	1.05
Fe <sub>2</sub> O <sub>3</sub> -----	.97	1.05	1.21	TiO <sub>2</sub> -----	.88	.68	.60
FeO-----	5.21	3.62	3.17	P <sub>2</sub> O <sub>5</sub> -----	.23	.19	.21
MgO-----	2.56	2.40	1.42	MnO-----	.10	.09	.09
CaO-----	5.79	4.38	4.86				
Na <sub>2</sub> O-----	2.48	2.42	2.40		100.73	100.20	100.08
K <sub>2</sub> O-----	2.79	3.30	3.04				

D-H. Five rocks from the Pend Oreille district, collected by J. L. Gillson and described in Prof. Paper 158, pp. 111-121, 1930. Analyses by J. G. Fairchild, record C-405.

D. Garnet vesuvianite, metamorphosed magnesian limestone, Cape Horn, near Bayview.

E. Sandy argillite from Prichard formation, north of Kilroy Bay.

F. Metamorphosed argillite from Prichard formation.

G. Metamorphosed lower sandstone of Blacktail formation, Chilco Mountain.

H. Same as D but with extreme metamorphism.

	D	E	F	G	H		D	E	F	G	H
SiO <sub>2</sub> -----	40.97	69.06	66.95	-----	-----	CO <sub>2</sub> -----	0.89	-----	-----	-----	-----
Al <sub>2</sub> O <sub>3</sub> -----	13.89	15.88	15.35	-----	-----	P <sub>2</sub> O <sub>5</sub> -----	.25	Trace	0.30	-----	-----
Fe <sub>2</sub> O <sub>3</sub> -----	4.56	1.21	.63	-----	-----	Cl-----	.15	-----	-----	-----	-----
FeO-----	2.87	3.17	4.19	-----	-----	F-----	Trace	-----	-----	-----	-----
MgO-----	3.06	1.09	2.01	-----	-----	MnO <sup>1</sup> -----	.12	Trace	.05	-----	-----
CaO-----	31.99	None	.62	-----	-----	BaO-----	None	0.10	None	0.02	0.02
Na <sub>2</sub> O-----	.08	1.62	6.57	0.28	0.88	ZrO <sub>2</sub> -----	Trace	.03	.07	.03	.05
K <sub>2</sub> O-----	.08	3.96	Trace	2.38	2.38						
H <sub>2</sub> O-----	.04	None	None	-----	-----						
H <sub>2</sub> O+-----	.38	1.98	1.96	-----	-----						
TiO <sub>2</sub> -----	.48	.75	1.00	.12	.14	Less O=Cl-----	99.78	-----	-----	-----	-----
								99.81	98.85	99.70	-----

<sup>1</sup> Approximate determination.

<sup>2</sup> Sample contains organic carbon, probably graphitic.

#### MISCELLANEOUS ROCKS

A. Nephelite basalt, Fort Hall Indian Reservation, described by Mansfield and Larsen, Washington Acad. Sci. Jour., vol. 5, p. 463, 1915. Diopside, nephelite, forsterite, biotite, magnetite, ilmenite, apatite. Analysis by W. C. Wheeler, record 2902.

B-F. Lavas from Bayhorse region, Custer County, submitted by C. P. Ross. Partial analyses by George Steiger, record D-158.

B. Mill Creek, station 111.

C. South side of old Mackay stage road, station 132.

D. Twin Bridge Creek, station 12.

E. Near Howell's ranch, station 57.

F. On ridge above station 126, at head of Garden Creek.

	A	B	C	D	E	F
SiO <sub>2</sub> -----	45.17	70.52	62.35	53.53	67.26	63.54
Al <sub>2</sub> O <sub>3</sub> -----	10.02	-----	-----	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> -----	3.55	-----	-----	-----	-----	-----
FeO-----	5.03	-----	-----	-----	-----	-----
MgO-----	19.84	-----	-----	-----	-----	-----
CaO-----	8.57	1.07	4.98	7.42	3.70	3.11
Na <sub>2</sub> O-----	3.11	3.48	3.44	2.62	4.02	3.34
K <sub>2</sub> O-----	1.61	4.90	2.74	3.94	3.44	5.16
H <sub>2</sub> O-----	.69	-----	-----	-----	-----	-----
H <sub>2</sub> O+-----	1.58	-----	-----	-----	-----	-----
TiO <sub>2</sub> -----	.54	-----	-----	-----	-----	-----
CO <sub>2</sub> -----	None	-----	-----	-----	-----	-----
P <sub>2</sub> O <sub>5</sub> -----	.28	-----	-----	-----	-----	-----
S-----	.06	-----	-----	-----	-----	-----
Cr <sub>2</sub> O <sub>3</sub> -----	.11	-----	-----	-----	-----	-----
MnO-----	.13	-----	-----	-----	-----	-----
BaO-----	.07	-----	-----	-----	-----	-----
SrO-----	.06	-----	-----	-----	-----	-----
	100.42	-----	-----	-----	-----	-----



MAINE

- A. Amphibole schist, Scarborough.
- B. Same, south of Portland Heights.
- C. Granite porphyry, Long Island.
- D. Same, Steve Island. All four analyses by W. C. Wheeler, record 2896.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> -----	54.51	58.46	69.90	66.74	H <sub>2</sub> O-----	0.24	0.19	0.28	0.29
Al <sub>2</sub> O <sub>3</sub> -----	17.82	19.88	16.78	16.67	H <sub>2</sub> O+-----	1.03	4.55	.78	.78
Fe <sub>2</sub> O <sub>3</sub> -----	.67	.97	.47	.67	TiO <sub>2</sub> -----	1.29	.41	.39	.31
FeO-----	8.59	8.42	2.00	2.99	CO <sub>2</sub> -----	.90	.15	.17	.11
MgO-----	2.61	1.65	.48	1.14	P <sub>2</sub> O <sub>5</sub> -----	.31	Trace	.09	.10
CaO-----	7.18	2.13	.74	3.55	MnO-----	.14	.03	.06	.01
Na <sub>2</sub> O-----	4.03	1.17	4.84	4.46					
K <sub>2</sub> O-----	.43	1.15	3.64	2.16		99.75	99.16	100.62	99.98

MARYLAND

Pegmatite, Wright quarry, 2 miles from Marriotsville station, collected by F. J. Katz and described in Mineral Resources for 1915, pt. 2, pp. 43-49, 1917. Analysis by George Steiger, record 3160.

SiO <sub>2</sub> -----	64.08	Na <sub>2</sub> O-----	2.14	TiO <sub>2</sub> -----	0.08
Al <sub>2</sub> O <sub>3</sub> -----	18.63	K <sub>2</sub> O-----	12.32	CO <sub>2</sub> -----	.40
Fe <sub>2</sub> O <sub>3</sub> -----	.44	H <sub>2</sub> O-----	None		
MgO-----	.17	H <sub>2</sub> O+-----	.69		99.89
CaO-----	.94				

MASSACHUSETTS

A. Composite sample of Berkshire schist, section across Mount Washington, Sheffield quadrangle. Quartz, muscovite, biotite, plagioclase, feldspar, garnet, staurolite, calcite, magnetite, and graphite. Collected by Joseph Barrell. Analysis by R. C. Wells, with corrected fluorine determinations by J. G. Fairchild, record 2431.

B-D. Three rocks collected by B. K. Emerson. Analyses by Chase Palmer, record 3146.

B. Oakdale quartzite, Groton cemetery. Carboniferous. Quartz, biotite, traces of muscovite, garnet, graphite.

C. Same, Pepperill Bridge. Minerals as in B, with tourmaline.

D. Same, Dunstable. Same minerals as in B, with titanite.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> -----	59.29	62.67	66.94	71.77	P <sub>2</sub> O <sub>5</sub> -----	0.17	0.20	0.18	0.01
Al <sub>2</sub> O <sub>3</sub> -----	19.54	17.15	13.18	12.40	F-----	.05			
Fe <sub>2</sub> O <sub>3</sub> -----	1.82	.72	.79	.37	S-----	.04	.07	.11	.07
FeO-----	5.65	3.75	4.73	4.17	Cr <sub>2</sub> O <sub>3</sub> -----	.02			
MgO-----	1.75	2.89	3.25	3.31	V <sub>2</sub> O <sub>5</sub> -----	.03			
CaO-----	1.16	2.85	2.21	2.94	MnO-----	.25	.02	.09	.03
Na <sub>2</sub> O-----	1.25	2.38	2.38	1.26	BaO-----	.05			
K <sub>2</sub> O-----	3.25	4.03	2.58	2.48	SrO-----	Trace			
H <sub>2</sub> O-----	.13	.04	.08	.09					
H <sub>2</sub> O+-----	4.06	1.28	1.88	.98		99.71	99.37	99.37	100.56
TiO <sub>2</sub> -----	.99	.75	.67	.68	Less O-----	.02			
ZrO <sub>2</sub> -----	.01								
CO <sub>2</sub> -----	.20	.57	.30	None		99.69			

E. Granite from Cape Ann, Essex County.

F. Material dissolved from same by nitric acid (2,000 cc of specific gravity 1.20) standing in a hole 15 cm in diameter and 15 cm deep for 2½ years, covered. Volume of final solution, 1,400 cc. Results in grams found in 1,400 cc.

G. Residual granite 15 mm from outer surface.

H. Residual granite 15 to 38 mm from outer surface. Analyses E-H by George Steiger, record C-420.

	E	F	G	H		E	F	G	H
SiO <sub>2</sub> -----	74.37	.08	76.02	74.34	H <sub>2</sub> O+-----	0.32		0.30	0.27
Al <sub>2</sub> O <sub>3</sub> -----	12.61	5.84	12.53	12.70	TiO <sub>2</sub> -----	.17	0.24	.07	.18
Fe <sub>2</sub> O <sub>3</sub> -----	.57	13.24	.60	.53	CO <sub>2</sub> -----	.04		None	.03
FeO-----	2.01		.99	1.91	P <sub>2</sub> O <sub>5</sub> -----	Trace		Trace	( <sup>1</sup> )
MgO-----	.04	.21	.05	.05	MnO-----	.04	.26	.03	( <sup>1</sup> )
CaO-----	.77	10.64	.46	.74	Li <sub>2</sub> O-----	.04	( <sup>1</sup> )	( <sup>1</sup> )	.02
Na <sub>2</sub> O-----	4.39	2.50	4.50	4.65					
K <sub>2</sub> O-----	4.38	2.59	4.39	4.42		99.88	35.60	100.21	99.91
H <sub>2</sub> O-----	.13		.27	.07					

<sup>1</sup>Not determined.



## MISSISSIPPI

Nephelite syenite from Rankin County, depth 4,027 feet, submitted by S. H. Rook through C. S. Ross. Analysis by J. J. Fahey, record D-80.

SiO <sub>2</sub> .....	46.97	K <sub>2</sub> O.....	5.44	MnO.....	0.13
Al <sub>2</sub> O <sub>3</sub> .....	19.97	H <sub>2</sub> O.....	.06	BaO.....	.21
Fe <sub>2</sub> O <sub>3</sub> .....	3.78	H <sub>2</sub> O+.....	1.06	SrO.....	.47
FeO.....	1.91	TiO <sub>2</sub> .....	.93		
MgO.....	.65	CO <sub>2</sub> .....	1.49		99.94
CaO.....	7.22	P <sub>2</sub> O <sub>5</sub> .....	.21		
Na <sub>2</sub> O.....	9.04	SO <sub>3</sub> .....	.40		

## MONTANA

A-C. Porphyritic rocks from Flathead mine, collected by P. J. Shenon. Analyses by George Steiger, record D-250.

A. Latite with large phenocrysts of sanidine and smaller ones of oligoclase in a microcrystalline groundmass.

B. Dense gray rock with flow structure and few phenocrysts.

C. Porphyry similar to A but finer-grained. Some zircon, titanite, and magnetite.

D. Igneous rock collected by Frank Reeves from a sill 11 miles west of Winnett, sec. 6, T. 14 N., R. 25 E. Described as nephelite-haüynite-alnoite by C. S. Ross in Am. Jour. Sci., 5th ser., vol. 11, p. 218, 1924. Olivine, phlogopite, haüynite, melilite, nephelite, augite, magnetite, apatite. Analysis by J. G. Fairchild, record C-312-b.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	67.11	64.96	67.16	39.19	BaO.....	0.18			
Al <sub>2</sub> O <sub>3</sub> .....	17.17	17.80	16.50	8.41	MnO.....				0.24
Fe <sub>2</sub> O <sub>3</sub> .....	1.71	2.32	2.52	3.47	SO <sub>3</sub> .....	.38			1.34
FeO.....	.35	.55	.35	5.51	S.....	1.12			Trace
MgO.....	None	.38	.21	22.78	Cr <sub>2</sub> O <sub>3</sub> .....				.11
CaO.....	1.32	2.10	2.32	8.90	ZrO <sub>2</sub> .....	.04			
K <sub>2</sub> O.....	3.26	3.93	3.63	3.23					
Na <sub>2</sub> O.....	3.46	5.27	5.26	2.14		100.35	99.78	99.73	100.47
H <sub>2</sub> O.....	1.10	.95	.84	.56	Less O=S.....	.42			
H <sub>2</sub> O+.....	2.40	.87	.33	3.66					
TiO <sub>2</sub> .....	.52	.51	.41	.40		99.93			
P <sub>2</sub> O <sub>5</sub> .....	.23	.14	.20	.53					

## NEVADA

## DELAMAR MINING DISTRICT

Rocks collected by Eugene Callaghan. Analyses by J. J. Fahey, record D-233.

A. Lava overlying rhyolite dikes.

B. Intrusive granodiorite porphyry.

C. Coarse phase of B.

D. Rhyolite dike mineralized in the Magnolia mine.

E. Sills earlier than some of the faulting.

F. "Black porphyry" of dikes.

G. Late rhyolite dike traversing ore shoot.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	71.42	56.85	60.68	76.67	47.67	50.68	77.28
Al <sub>2</sub> O <sub>3</sub> .....	13.70	17.78	15.29	12.23	13.45	14.97	13.15
Fe <sub>2</sub> O <sub>3</sub> .....	.81	2.20	2.57	1.08	3.35	2.06	.43
FeO.....	1.70	4.32	3.68	.57	11.40	5.71	.53
TiO <sub>2</sub> .....	.36	.97	.99	.10	2.18	.47	.18
CaO.....	1.87	5.75	4.06	None	3.40	6.01	None
MgO.....	.89	3.72	3.24	None	8.77	7.04	.02
Na <sub>2</sub> O.....	2.24	2.89	2.88	2.42	1.28	1.59	.09
K <sub>2</sub> O.....	4.52	2.80	4.10	5.74	.99	2.62	6.26
H <sub>2</sub> O.....	1.58	1.78	2.15	.97	5.00	3.01	1.76
CO <sub>2</sub> .....	1.14	.89	None	None	2.42	4.99	None
P <sub>2</sub> O <sub>5</sub> .....	None	.40	.51	None	.52	.55	.30
MnO.....	.03	.06	.08	.06	.06	.11	.02
	100.26	100.41	100.23	99.84	100.47	99.81	100.02



ROCHESTER DISTRICT

Three rocks collected by Adolph Knopf and described in Bull. 762, 1924. Analyses by R. C. Wells, record 3187.

A. Soft white rock carrying cinnabar, American Canyon. Sericite and quartz.

B. Aplite, Black Range. Feldspar and quartz. Cuts Triassic rocks.

C. Trachyte from Gold Mountain. Phenocrysts of microcline in a groundmass of spherulites of feldspar.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	74.58	77.10	67.01	K <sub>2</sub> O.....	4.47	6.17	11.42
Al <sub>2</sub> O <sub>3</sub> .....	17.24	12.28	15.97	H <sub>2</sub> O.....	2.72	.76	.28
Fe <sub>2</sub> O <sub>3</sub> .....	.65	1.04	2.54	TiO <sub>2</sub> .....	.17	.03	.39
FeO.....			.44	CO <sub>2</sub> .....	Trace	Trace	-----
MgO.....	Trace	.04	Trace				
CaO.....	.18	.24	.19		100.28	99.93	100.16
Na <sub>2</sub> O.....	.27	2.27	1.92				

YERINGTON DISTRICT

Rocks collected by Adolph Knopf and described in U. S. Geol. Survey Prof. Paper 114, 1918. A-C, analyses by George Steiger, record 3059. D-E, partial analyses by R. C. Wells, record 3044. F, analysis by W. B. Hicks, record 3124. G-H, analyses by R. C. Wells, record 3022.

A. Quartz monzonite. Orthoclase, microperthite, microcline, plagioclase, quartz, biotite, hornblende, and accessory titanite, magnetite, apatite, and zircon.

B. Granodiorite. Plagioclase, orthoclase, quartz, biotite, and hornblende.

C. Vitrophyre. Phenocrysts of biotite, augite, and plagioclase.

D-E. Two felsites with cryptocrystalline aggregates of feldspars and quartz.

F. Matrix of garnet.

G. Keratophyre.

H. Pyroxene from gangue of Mason mine.

	A	B	C	D	E	F	G	H
SiO <sub>2</sub> .....	68.35	57.90	66.03	77.17	70.18	40.89	72.73	50.59
Al <sub>2</sub> O <sub>3</sub> .....	14.71	16.38	14.98	<sup>1</sup> 13.84	<sup>1</sup> 18.43	7.63	14.42	.11
Fe <sub>2</sub> O <sub>3</sub> .....	1.69	3.02	1.65	-----	-----	<sup>2</sup> 15.39	.73	1.18
FeO.....	1.47	3.66	1.67	-----	-----	-----	.94	13.05
MgO.....	1.11	3.13	.99	-----	-----	1.26	.32	9.19
CaO.....	3.11	6.33	2.62	1.47	2.55	30.61	.87	23.03
Na <sub>2</sub> O.....	4.28	4.10	3.60	6.05	7.46	-----	4.66	.15
K <sub>2</sub> O.....	3.54	2.52	4.34	.38	.44	-----	4.50	.16
H <sub>2</sub> O.....	.31	.18	.44	-----	-----	-----	.36	.71
H <sub>2</sub> O+.....	.46	.89	2.46	-----	-----	-----	.36	.58
TiO <sub>2</sub> .....	.57	1.12	.48	-----	-----	-----	.22	.13
ZrO <sub>2</sub> .....	None	None	None	-----	-----	-----	.04	.02
CO <sub>2</sub> .....	.14	.08	.07	-----	-----	-----	.19	1.52
P <sub>2</sub> O <sub>5</sub> .....	.20	.42	.11	-----	-----	-----	.07	Trace
S.....	-----	-----	-----	-----	-----	-----	-----	.02
Cr <sub>2</sub> O <sub>3</sub> .....	-----	-----	-----	-----	-----	-----	-----	None
V <sub>2</sub> O <sub>5</sub> .....	-----	-----	-----	-----	-----	-----	-----	Trace
MnO.....	.04	.09	.07	-----	-----	-----	.01	.26
BaO.....	.06	.06	.11	-----	-----	-----	.09	None
SrO.....	.07	.08	.08	-----	-----	-----	-----	-----
	100.11	99.96	99.70	-----	-----	-----	100.51	100.70

<sup>1</sup> Al<sub>2</sub>O<sub>3</sub>, etc.

<sup>2</sup> Total Fe.

Matrix of garnet. Partial analysis by W. B. Hicks, record 3124.

SiO <sub>2</sub> .....	40.89	MgO.....	1.26
Al <sub>2</sub> O <sub>3</sub> .....	7.63	CaO.....	30.61
Fe <sub>2</sub> O <sub>3</sub> (total Fe).....	15.39		

MISCELLANEOUS ROCKS

A-C. Three samples collected by A. C. Spencer near Reipetown, Ely district, described in Prof. Paper 96, 1917. Analyses by R. C. Wells, with corrected fluorine determination by J. G. Fairchild, record 2592.



A. Monzonite from Weary Flat. Orthoclase, plagioclase, hornblende, sphene, magnetite, apatite, zircon.

B. Siliceous porphyry ore, Copper Flat mine.

C. Capping porphyry, Copper Flat mine.

D. Quartz monzonite collected by J. L. Gillson in the Pioche district and described in Prof. Paper 171, 1932. Subporphyritic. Quartz, feldspars, biotite, hornblende, accessories. Analysis by J. G. Fairchild, record C-712.

E-F. Two rocks collected by T. B. Nolan from the Mountain City district. Analyses by J. G. Fairchild, record D-209.

E. Keratophyre 1,000 feet west of portal of main tunnel of Silver Banner mine. Phenocrysts of calcic albite, augite, and sparse quartz with some apatite in a glass matrix.

F. Granite from Point of Rocks, across California Gulch from mine. Calcic oligoclase, perthitic orthoclase, quartz, biotite, hornblende, and accessory apatite and rutile.

G. Latite of recent age collected by Adolph Knopf and described in Bull. 715, 1921. Partial analysis by R. C. Wells, record 3257. Plagioclase, biotite, and hornblende.

H. Altered rock from Tuscarora, collected by T. B. Nolan. Analysis by Charles Milton, record D-464. Boiling with 5 percent sodium carbonate for 15 minutes dissolved about 1 percent of  $\text{SiO}_2$  and a little  $\text{Al}_2\text{O}_3$ .

	A	B	C	D	E	F	G	H
$\text{SiO}_2$ .....	57.26	74.62	80.58	65.84	69.59	66.80	69.97	75.47
$\text{Al}_2\text{O}_3$ .....	17.79	10.23	8.51	15.29	13.17	-----	-----	14.48
$\text{Fe}_2\text{O}_3$ .....	3.39	-----	1.15	2.48	1.75	-----	-----	1.08
FeO.....	3.45	.55	( <sup>1</sup> )	2.26	2.30	-----	-----	-----
MgO.....	2.02	.83	None	1.06	.15	-----	-----	.74
CaO.....	6.58	Trace	.15	3.05	1.49	.3.26	1.77	.20
$\text{Na}_2\text{O}$ .....	3.06	.33	.41	3.47	2.82	3.47	4.20	.03
$\text{K}_2\text{O}$ .....	4.15	6.57	5.33	4.53	5.55	4.45	5.02	3.02
$\text{H}_2\text{O}$ .....	.53	.26	.45	.01	.74	-----	-----	1.63
$\text{H}_2\text{O}+$ .....	.55	.69	1.29	.67	2.09	-----	-----	3.37
$\text{TiO}_2$ .....	.71	.42	.29	1.00	.80	-----	-----	.21
$\text{CO}_2$ .....	.04	-----	None	-----	-----	-----	-----	-----
$\text{P}_2\text{O}_5$ .....	.21	.06	-----	.19	.05	-----	-----	-----
F.....	.12	-----	-----	-----	-----	-----	-----	-----
Cl.....	Trace	-----	-----	-----	-----	-----	-----	-----
MnO.....	.29	-----	None	.09	.09	-----	-----	-----
BaO.....	.07	-----	.06	-----	-----	-----	-----	-----
SrO.....	Trace	-----	-----	-----	-----	-----	-----	-----
Cu.....	Trace	-----	-----	-----	-----	-----	-----	-----
$\text{FeS}_2$ .....	.13	2.32	1.54	-----	-----	-----	-----	-----
$\text{CuFeS}_2$ .....	-----	2.25	.29	-----	-----	-----	-----	-----
$\text{Cu}_2\text{S}$ .....	-----	.98	.13	-----	-----	-----	-----	-----
Less O.....	100.35	100.11	100.18	99.94	100.59	-----	-----	100.23
	.05	-----	-----	-----	-----	-----	-----	-----
	100.30	-----	-----	-----	-----	-----	-----	-----

<sup>1</sup> Undetermined.

I-M. Rocks collected in the Paradise Range, Mineral County, by Eugene Callaghan. Samples I, J described in Nevada Univ. Bull., vol. 27, no. 1, pp. 1-33, 1933. Analyses by George Steiger, record D-157. Analyses K-M also by Steiger, record D-424.

I. Diorite dike in lower brucite deposit. Feldspar, quartz, pyroxene, titanite, apatite, mica, carbonates.

J. Granodiorite from east side of hill northwest of upper brucite deposit. Andesine, oligoclase, orthoclase, quartz, biotite, hornblende, magnetite, apatite, titanite, sericite, green biotite.

K. Granodiorite aplite, brucite deposit, Paradise Range.

L. Lamprophyre, brucite deposit, Paradise Range.

M. Andesite porphyry, brucite deposit, Paradise Range.

N. A rock from Tuscarora, consisting of adularia and quartz, collected by T. B. Nolan. Analysis by J. J. Fahey, record D-275.

O. Volcanic ash from Kaolin, Wash., collected by W. W. Rubey. Analysis by Charles Milton, record D-305.



	I	J	K	L	M	N	O
SiO <sub>2</sub> .....	58.52	65.33	73.69	53.11	61.72	74.75	57.72
Al <sub>2</sub> O <sub>3</sub> .....	14.55	15.75	13.92	16.78	17.10	13.61	17.18
Fe <sub>2</sub> O <sub>3</sub> .....	1.50	1.92	.73	2.06	1.78	.83	1.40
FeO.....	1.50	2.42	.55	4.68	3.10	-----	.87
MgO.....	6.79	1.82	.61	3.84	2.90	.21	3.10
CaO.....	4.16	4.17	1.55	6.31	5.04	.02	1.90
Na <sub>2</sub> O.....	3.79	3.92	3.59	3.28	5.03	.82	3.12
K <sub>2</sub> O.....	5.74	2.61	4.00	2.25	1.50	7.70	3.71
H <sub>2</sub> O.....	.83	.18	.28	.44	.17	} 1.58	{ 4.90
H <sub>2</sub> O+.....	2.25	.76	.91	2.90	.95		
P <sub>2</sub> O <sub>5</sub> .....	.14	.20	.08	.56	.25	-----	.06
TiO <sub>2</sub> .....	.38	.51	.24	1.13	.63	.40	.40
MnO.....	.06	.07	.02	.10	.10	-----	-----
SO <sub>3</sub> .....	-----	-----	-----	-----	-----	-----	Trace
CO <sub>2</sub> .....	.69	.08	.13	2.33	.10	-----	.56
	99.90	99.74	100.30	100.07	100.37	99.92	99.87

NEW JERSEY

Altered syenite from Rutan Hill, Beemerville, collected and analyzed by Charles Milton, record D-264. Calcite, biotite, albite, magnetite, apatite, ilmenite, pyrite.

SiO <sub>2</sub> .....	14.87	MnO.....	.25	F.....	0.20
Al <sub>2</sub> O <sub>3</sub> .....	6.28	Na <sub>2</sub> O.....	2.40	Cl.....	.02
Fe <sub>2</sub> O <sub>3</sub> .....	5.68	K <sub>2</sub> O.....	2.12	S.....	.12
TiO <sub>2</sub> .....	2.44	P <sub>2</sub> O <sub>5</sub> .....	2.38		
FeO.....	8.14	CO <sub>2</sub> .....	21.28		100.59
CaO.....	29.78	H <sub>2</sub> O.....	.07	O = F <sub>2</sub> .....	.13
MgO.....	3.53	H <sub>2</sub> O+.....	1.03		100.46

NEW MEXICO

ABIQUIU QUADRANGLE

Rocks collected by E. S. Larsen. Analyses by J. G. Fairchild, record C-253.

A. Quartz-olivine-pyroxene andesite, from upper floor on north slope of Santa Clara Canyon, just south of road to Bear Creek. Feldspar 60 percent, augite 19 percent, olivine 10 percent, quartz 6 percent, iron ores 5 percent.

B. Olivine-augite andesite from Cerro Aire, near Tres Piedras. Cristobalite conspicuous.

C. Quartz basalt from Jemez Mountains, 18 miles northeast of Española. Augite, olivine, magnetite.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	56.90	57.58	56.62	H <sub>2</sub> O.....	0.09	0.12	0.10
Al <sub>2</sub> O <sub>3</sub> .....	15.60	15.76	15.62	H <sub>2</sub> O+.....	.39	.37	.61
Fe <sub>2</sub> O <sub>3</sub> .....	3.12	4.03	3.24	TiO <sub>2</sub> .....	1.45	1.50	1.41
FeO.....	3.97	3.76	3.92	P <sub>2</sub> O <sub>5</sub> .....	.32	.51	.34
MgO.....	5.36	3.30	5.32	MnO.....	.15	.15	.14
CaO.....	7.04	6.26	7.28				
Na <sub>2</sub> O.....	3.97	4.44	3.24		100.51	100.60	100.72
K <sub>2</sub> O.....	2.15	2.82	2.88				

SAN JUAN REGION

A-H. Rocks collected by E. S. Larsen. Analyses A-G by George Steiger, record 3289; H by R. K. Bailey, record C-421-a.

A. Basalt from Buffalo Buttes, 20 miles south of Antonio, Colo. Augite 60 percent, plagioclase (Ab<sub>32</sub>An<sub>68</sub>) 33 percent, magnetite 4 percent, olivine 3 percent.

B. Cristobalite dacite from Antonio Peak, 16 miles south of Antonio, Colo. Augite and hypersthene 13 percent, magnetite 3.5 percent, plagioclase (Ab<sub>45</sub>An<sub>55</sub>) 83.5 percent, orthoclase and cristobalite.

C. Rhyolite obsidian from Cerro No Agua, 1 mile west of Tres Piedras. Some feldspar phenocrysts.



D. Latite from mountain north of Hermit Lake.

E. Basalt near Taos Junction, SW $\frac{1}{4}$  sec. 20, T. 26 N., R. 10 E. Plagioclase (Ab<sub>40</sub>An<sub>60</sub>) 60 percent, augite 24 percent, olivine 11 percent, magnetite and ilmenite 3 percent.

F. Glassy basalt pumice from volcanic cone on Tusas Creek, near San Pablo, containing a few crystals of augite. The iron in the pumice is mostly oxidized. Resembles the rock from Ortiz Peak (DD, p. 35) in composition.

G. Basalt from volcanic cone 2 miles southeast of Brazos Peak. Andesine, a few ferromagnesian minerals, and iron oxides.

H. Quartz latite  $2\frac{1}{4}$  miles southeast of Brazos Peak, Rio Arriba County.

	A	B	C	D	E	F	G	H
SiO <sub>2</sub> -----	50.38	63.74	73.51	72.02	49.65	56.60	51.94	73.39
Al <sub>2</sub> O <sub>3</sub> -----	16.55	15.38	12.86	15.28	16.95	15.05	17.74	14.82
Fe <sub>2</sub> O <sub>3</sub> -----	1.45	2.63	.35	.97	2.11	7.57	4.95	.67
FeO-----	9.78	2.76	.42	.74	8.54	1.36	6.20	.44
MgO-----	7.54	1.90	.15	.26	7.44	5.29	3.40	.34
CaO-----	9.27	4.57	.60	2.00	8.92	6.84	6.65	1.87
Na <sub>2</sub> O-----	2.88	3.84	4.38	3.79	3.21	3.37	4.08	4.40
K <sub>2</sub> O-----	.50	3.15	4.32	4.35	1.13	1.82	2.02	4.20
H <sub>2</sub> O-----	.18	.64	.24	.45	.40	.47	.15	.40
H <sub>2</sub> O+-----	.44	.35	3.26	.40	.35	.51	.31	.04
TiO <sub>2</sub> -----	1.04	.81	None	.22	1.49	1.05	2.32	.14
ZrO <sub>2</sub> -----	None	-----	.02	-----	-----	-----	-----	-----
CO <sub>2</sub> -----	None	None	None	None	None	-----	None	None
P <sub>2</sub> O <sub>5</sub> -----	.12	.20	.01	.02	.30	.12	.42	None
MnO-----	.13	.07	.02	.11	.13	.12	.15	.04
BaO-----	None	None	None	-----	-----	-----	-----	-----
SrO-----	None	.06	None	None	-----	.07	.11	-----
	100.26	100.15	100.14	100.61	100.62	100.24	100.44	100.75

I-AA. Nineteen specimens of volcanic rocks from the San Juan district, submitted by C. S. Ross, including three submitted by E. S. Larsen. Analyses by J. G. Fairchild, record C-1090.

I. Rhyolite from head of Vallecitos Creek, near divide above Boyd's ranch, 30 miles northwest of Santa Fe.

J. Rhyolite pumice north of Palado Creek, 2 miles northwest of Boyd's ranch.

K. Andesite of basaltic habit from head of Vallecitos Creek, near divide above Boyd's ranch.

L. Andesite from gulch of Pipe Line Canyon about  $1\frac{1}{2}$  miles east of Boyd's ranch.

M. Rhyolite tuff from scarp above Bennett mine, Jemez Canyon, 45 miles west of Santa Fe.

N. Rhyolite from east flank of Redondo Peak, 36 miles northwest of Santa Fe.

O. Hornblende andesite from east slope of Tetilla Peak, 14 miles southwest of Santa Fe.

P. Obsidian from top of Bearface Mountain, 32 miles west of Santa Fe.

Q. Spherulites from obsidian, Valle de los Pozos, near head of San Antonio Creek, 34 miles northwest of Santa Fe.

R. Obsidian enclosing spherulites.

S. Basalt from Polvaderas Creek, 3 miles south of Canones and 42 miles northwest of Santa Fe.

T. Obsidian from La Cueva, Jemez Creek, 42 miles west of Santa Fe.

U. Obsidian fragments (later volcanic series) from lower white tuff on Peralta Creek.

V. Andesite from east slope of Cerro Montoya, about 10 miles west of Santa Fe.

W. Rhyolite, banded rock 2 miles southeast of La Cueva and about 18 miles north of Jemez.

X. Stony material from cliff east of creek and near road; same locality as O.

Y. Latite of Valles Mountain, north side of Santa Clara Creek, 0.5 mile above lower contact, Rio Arriba County.

Z. Younger volcanic series, Valles Mountain, hornblende andesite west base of peak 8,500, between Bear Creek and Santa Clara, Rio Arriba County.

AA. Andesite from Valles Mountain.



	I	J	K	L	M	N	O	P	Q
SiO <sub>2</sub> -----	76.16	68.87	59.51	64.13	76.75	73.04	62.05	73.75	77.14
Al <sub>2</sub> O <sub>3</sub> -----	12.71	12.69	15.39	14.96	12.08	13.49	15.48	12.00	12.19
Fe <sub>2</sub> O <sub>3</sub> -----	.87	2.47	2.61	3.34	1.25	1.70	3.59	.49	.62
FeO-----	.51	1.59	3.97	.85	.80	.79	1.78	.73	.76
MgO-----	.05	.73	2.81	1.21	.12	.10	2.09	.10	.45
CaO-----	.41	2.06	5.89	3.43	.17	.47	4.95	.45	.02
Na <sub>2</sub> O-----	3.55	3.31	3.84	3.49	3.94	3.71	4.10	3.44	5.44
K <sub>2</sub> O-----	5.35	4.59	2.93	4.45	5.11	5.60	3.56	5.22	3.20
H <sub>2</sub> O-----	.05	.20	.13	.56	.05	.05	.21	.05	None
H <sub>2</sub> O+-----	.36	3.60	1.47	1.44	.11	.63	.81	4.25	.45
TiO <sub>2</sub> -----	.14	.35	1.60	.60	.10	.35	.60	.05	.10
P <sub>2</sub> O <sub>5</sub> -----	.07	.12	.43	.27	.05	.12	.74	.05	Trace
CO <sub>2</sub> -----				1.09					
	100.23	100.58	100.58	99.82	100.53	100.05	99.96	100.58	100.37

	R	S	T	U	V	W	X	Y	Z	AA
SiO <sub>2</sub> -----	76.17	49.58	72.56	76.59	60.95	73.29	75.31	68.32	63.61	57.30
Al <sub>2</sub> O <sub>3</sub> -----	12.38	15.77	13.30	12.36	15.30	12.63	12.38	15.59	15.69	15.48
Fe <sub>2</sub> O <sub>3</sub> -----	.58	2.92	.88	.41	1.98	.84	.98	2.79	3.71	2.67
FeO-----	1.07	8.40	1.74	1.00	4.04	2.25	1.60	.30	.51	3.41
MgO-----	.13	6.38	.81	Trace	2.84	.10	.10	1.84	1.85	1.49
CaO-----	.37	10.22	1.77	.40	5.19	1.78	1.01	3.14	4.23	5.19
Na <sub>2</sub> O-----	3.92	3.02	3.01	3.49	3.76	3.32	3.66	3.34	3.82	3.41
K <sub>2</sub> O-----	5.49	1.26	5.13	5.27	3.23	5.16	4.46	3.70	2.99	4.32
H <sub>2</sub> O-----	None	None	.05	.05	.07	None	None	.02	1.28	.42
H <sub>2</sub> O+-----	.17	.26	.31	.32	1.11	.34	.13	.15	1.74	1.28
TiO <sub>2</sub> -----	.10	2.52	.35	.14	1.00	.40	.23	.60	.75	.83
P <sub>2</sub> O <sub>5</sub> -----	Trace	.27	.10	.07	.50	.14	.13	.22	.22	.48
BaO-----					.15			.03	.05	
SrO-----								None		
CO <sub>2</sub> -----										4.34
	100.38	100.60	100.01	100.10	100.51	100.25	99.99	99.44	100.45	100.62

BB-II. Various rocks collected by E. S. Larsen in the San Juan region.

BB. Latite 1 mile south of big bend in San Antonio Creek, 7 miles west of San Antonio ranger station, Rio Arriba County. Phenocrysts of andesine, biotite, and lesser orthoclase in a glassy groundmass. Analysis by J. G. Fairchild, record C-421-b.

CC. Olivine andesite from sec. 4, T. 29 N., R. 6 E., 4 miles southeast of Brazos Peak and 0.5 mile from the Brazos River. Analysis by J. G. Fairchild, record C-547.

DD. Quartz andesite from Ortiz Peak. Analysis by G. V. Brown, record 3270. Plagioclase (Ab<sub>35</sub>An<sub>65</sub>), augite, magnetite, olivine, christobalite, orthoclase, and quartz.

EE. Basalt 6 miles east of the Rio Grande. About 30 percent femic minerals.

FF. From Brazos Canyon. Same minerals as EE.

GG. Basalt from Montosa, top of Cerro. Augite more abundant than olivine. Analyses EE-GG by J. G. Fairchild, record C-253.

HH, II. Volcanic glass from Valle de los Pozos, near head of San Antonio Creek, 34 miles northwest of Santa Fe, submitted by C. S. Ross. Analyses by J. G. Fairchild, record D-8.

HH. Glass immediately surrounding spherulites.

II. Normal glass, same specimen.

	BB	CC	DD	EE	FF	GG	HH	II
SiO <sub>2</sub> -----	75.79	58.08	54.76	57.58	48.72	57.08	74.39	75.50
Al <sub>2</sub> O <sub>3</sub> -----	11.63	15.30	16.38	15.76	14.00	15.32	12.80	12.60
Fe <sub>2</sub> O <sub>3</sub> -----	1.99	6.11	4.66	4.03	5.31	3.94	.39	.43
FeO-----	.25	1.35	4.88	3.76	7.55	3.84	1.42	1.33
MgO-----	.49	2.29	4.96	3.30	7.98	3.71	.05	.05
CaO-----	1.70	5.50	7.40	6.26	9.34	6.34	.82	.56
Na <sub>2</sub> O-----	2.42	3.42	3.04	4.44	3.02	4.52	3.82	3.86
K <sub>2</sub> O-----	4.04	4.48	2.18	2.82	.97	2.65	5.80	5.19
H <sub>2</sub> O-----	.46	.89	.15	.12	.03	.12		
H <sub>2</sub> O+-----	.73	.71	.34	.37	.55	.74	.49	.30
TiO <sub>2</sub> -----	.35	1.50	1.46	1.50	2.31	1.65	.12	.12
SrO-----			None					
P <sub>2</sub> O <sub>5</sub> -----	Trace	.45	Trace	.51	.25	.54		
BaO-----							.05	.05
MnO-----	.04		None	.15	.22	.14		
	99.89	100.08	100.21	100.60	100.25	100.59	100.15	99.99



## MISCELLANEOUS ROCKS

Monzonite from the Magdalena district, collected by A. H. Koschmann. Analysis by J. G. Fairchild, record D-20. Plagioclase, orthoclase, augite, biotite, hypersthene, quartz, hornblende, accessory magnetite, apatite, zircon.

SiO <sub>2</sub> .....	57.06	H <sub>2</sub> O.....	Trace	MnO.....	None
Al <sub>2</sub> O <sub>3</sub> .....	14.60	H <sub>2</sub> O+.....	0.53	BaO.....	0.20
Fe <sub>2</sub> O <sub>3</sub> .....	2.46	TiO <sub>2</sub> .....	1.59	SrO.....	Trace
FeO.....	5.02	CO <sub>2</sub> .....	Trace		
MgO.....	4.21	P <sub>2</sub> O <sub>5</sub> .....	.60		100.25
CaO.....	6.26	F.....	.14	Less O.....	.06
Na <sub>2</sub> O.....	3.45	S.....	.03		
K <sub>2</sub> O.....	4.04	V <sub>2</sub> O <sub>5</sub> .....	.06		100.18

Three latites, Deming quadrangle. Determinations by Chase Palmer, record 2895, gave SiO<sub>2</sub> only: 64.75, 58.93, 60.94.

## NEW YORK

Pegmatite, Kinkle's "back" quarry, Bedford. Described by F. J. Katz in Mineral Resources for 1915, pt. 2, pp. 43-49, 1917. Analysis by R. C. Wells, record 3135.

SiO <sub>2</sub> .....	73.27	CaO.....	1.21	TiO <sub>2</sub> .....	0.05
Al <sub>2</sub> O <sub>3</sub> .....	16.63	Na <sub>2</sub> O.....	5.53		
Fe <sub>2</sub> O <sub>3</sub> (total Fe).....	.49	K <sub>2</sub> O.....	2.22		100.14
MgO.....	.14	H <sub>2</sub> O (total).....	.80		

## NORTH CAROLINA

A. Average sample of pegmatite at Young's quarry, 4½ miles from Spruce Pine, collected by F. J. Katz and described in Mineral Resources for 1915, pt. 2, pp. 43-49, 1917. Analysis by George Steiger, record 3160.

B. Sericite schist, 0.5 mile N. 40° E. of Steppo Gap, Gaston County, Kings Mountain quadrangle, collected by D. B. Sterrett. Analysis by R. K. Bailey, record 3046.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	67.93	45.47	Na <sub>2</sub> O.....	2.54	4.83	TiO <sub>2</sub> .....	None	-----
Al <sub>2</sub> O <sub>3</sub> .....	17.11	38.09	K <sub>2</sub> O.....	11.25	4.63	CO <sub>2</sub> .....	0.02	-----
Fe <sub>2</sub> O <sub>3</sub> .....	.37	2.50	H <sub>2</sub> O.....	None	} 4.79			
MgO.....	None	.21	H <sub>2</sub> O+.....	.20			99.74	101.27
CaO.....	.32	.75						

## OREGON

## BAKER QUADRANGLE

A-G. Seven greenstone rocks collected by James Gilluly. Analyses by J. G. Fairchild, record D-74.

- A. Saddle west of Balm Creek, in NW¼ sec. 29, T. 7 S., R. 43 E.  
 B. No. 2 level, Poorman mine.  
 C. NE¼ sec. 35, T. 7 S., R. 42 E.  
 D. SW¼ sec. 21, T. 7 S., R. 41 E.  
 E. SW¼ sec. 23, T. 7 S., R. 41 E.  
 F. Mesa top, NE¼ sec. 8, T. 9 S., R. 42 E.  
 G. NE¼ sec. 34, T. 11 S., R. 41 E.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	72.31	53.30	53.15	75.04	81.33	73.49	78.31
Al <sub>2</sub> O <sub>3</sub> .....	12.76	15.16	14.39	13.39	9.21		
Fe <sub>2</sub> O <sub>3</sub> .....	1.94	2.54	1.28	1.61	1.09		
FeO.....	1.26	3.71	9.33	.87	.74		
MgO.....	1.32	4.14	4.74	.18	.40		
CaO.....	.10	2.97	7.04	.40	.25		
Na <sub>2</sub> O.....	3.69	5.55	4.58	6.36	3.25	.22	.05
K <sub>2</sub> O.....	3.82	.32	1.01	.83	1.66	2.55	3.86
H <sub>2</sub> O.....	.26	.18	.19	.24	.15	5.48	3.81
H <sub>2</sub> O+.....	1.48	3.14	2.02	1.07	1.12		
TiO <sub>2</sub> .....	.40	2.41	1.50	.10	.25		
CO <sub>2</sub> .....	Trace	None	.10	.10	.10		
P <sub>2</sub> O <sub>5</sub> .....	.15	.51	.19	.08	.05		
MnO.....	.08	.28	1.14	.05	.05		
BaO.....	.09	None	None	None	Trace		
FeS <sub>2</sub> .....	None	.40	Trace?	None	None		
	99.66	99.61	99.66	99.82	99.64		



H-K. Four rocks collected by James Gilluly. Analyses by J. G. Fairchild, record C-1126. All from T. 8 S., R. 43 E.

H. Quartz diorite, sec. 9. Hornblende, andesine, quartz, chlorite, apatite, ilmenite.

I. Albite granite, sec. 9. Albite, epidote, hornblende, quartz, chlorite, apatite, ilmenite.

J. Pseudoporphyrific albite granite, sec. 8, contains same minerals as I.

K. Similar to J, sec. 13.

	H	I	J	K		H	I	J	K
SiO <sub>2</sub> -----	54.67	67.81	73.81	77.04	H <sub>2</sub> O+-----	1.26	1.24	0.90	0.54
Al <sub>2</sub> O <sub>3</sub> -----	15.95	14.13	12.36	11.88	TiO <sub>2</sub> -----	1.16	.79	.70	.37
Fe <sub>2</sub> O <sub>3</sub> -----	2.08	1.50	.94	1.05	CO <sub>2</sub> -----	1.24	.45	.31	.14
FeO-----	7.48	4.04	2.97	1.32	P <sub>2</sub> O <sub>5</sub> -----	.11	.06	.04	.04
MgO-----	4.09	1.56	.78	.04	MnO-----	.17	.13	.10	None
CaO-----	7.97	3.76	1.62	1.28	BaO-----	None	None	None	None
Na <sub>2</sub> O-----	2.71	3.36	3.89	4.45	SrO-----	None	None	None	None
K <sub>2</sub> O-----	1.16	1.62	1.47	1.64					
H <sub>2</sub> O-----	None	.06	.04	None		100.05	100.51	99.93	99.79

BOHEMIA DISTRICT

Fine-grained or altered rocks collected by A. F. Buddington and Eugene Callaghan. Analyses by George Steiger, record D-54.

A. Dark-gray porphyritic andesite, Grizzly Saddle trail.

B. Altered porphyry, Excelsior vein, Champion mine.

C. Altered felsite, Champion mine.

D. Gray andesite, west slope South Grouse Mountain.

E. Altered andesite, tunnel on Evening Star raise.

F. Reddish andesite, near Bohemia Mountain.

G. Flow-structure felsite, Wild Hog adit, Vesuvius Basin.

H. Basalt, Gold Hill, Blue River district.

	A	B	C	D	E	F	G	H
SiO <sub>2</sub> -----	53.27	64.41	74.02	62.72	63.00	55.18	69.58	54.25
Al <sub>2</sub> O <sub>3</sub> -----	17.08	16.76	14.73	15.04	16.98	15.57	13.68	16.46
Fe <sub>2</sub> O <sub>3</sub> -----	2.93	5.85	1.84	1.73	4.51	3.20	1.39	3.08
FeO-----	6.06	.66	.40	4.44	1.06	6.06	1.88	5.92
MgO-----	5.12	.38	.30	2.19	.48	4.15	.63	4.46
CaO-----	9.60	.27	.31	3.83	.66	7.60	2.68	8.79
Na <sub>2</sub> O-----	2.28	.20	.62	4.18	.17	3.08	3.66	3.46
K <sub>2</sub> O-----	.72	1.80	2.64	2.26	2.10	1.40	3.22	.80
H <sub>2</sub> O-----	.15	1.06	.45	.34	2.07	.40	.45	.26
H <sub>2</sub> O+-----	1.52	4.28	3.89	1.91	4.73	2.03	1.46	1.32
TiO <sub>2</sub> -----	1.04	1.18	.52	.95	1.20	1.46	.44	1.28
CO <sub>2</sub> -----	.08	None	None	.38	None	.07	1.38	None
P <sub>2</sub> O <sub>5</sub> -----	.20	None	.10	.21	.03	.14	.09	.23
SO <sub>3</sub> -----	-----	.68	.20	-----	1.21	-----	-----	-----
S-----	-----	4.29	1.09	-----	3.03	-----	-----	-----
Mn-----	.15	None	None	.10	None	.14	.07	.13
Less O-----	100.20	101.82	101.11	100.28	101.23	100.48	100.61	100.44
		1.61	.41		1.14			
		100.21	100.70		100.09			

TAKILMA REGION

Basic rocks collected by P. J. Shenon. Analyses by J. G. Fairchild, record D-64. See U. S. Geol. Survey Bull. 846, pp. 157-159, 1933.

A. Greenstone or oligoclase andesite from SE<sup>1</sup>/<sub>4</sub>SW<sup>1</sup>/<sub>4</sub> sec. 36, T. 40 S., R. 8 W.

B. Greenish oligoclase diorite (metagabbro) from NW<sup>1</sup>/<sub>4</sub> sec. 16, T. 41 S., R. 8 W., bottom of Long Gulch. Both rocks fine-grained and somewhat altered.

	A	B		A	B		A	B
SiO <sub>2</sub> -----	49.31	49.60	Na <sub>2</sub> O-----	4.44	2.96	P <sub>2</sub> O <sub>5</sub> -----	0.19	0.18
Al <sub>2</sub> O <sub>3</sub> -----	13.72	14.10	K <sub>2</sub> O-----	.53	1.05	S (total)-----	.21	.05
Fe <sub>2</sub> O <sub>3</sub> -----	2.84	1.77	H <sub>2</sub> O-----	.37	.34	Cr <sub>2</sub> O <sub>3</sub> -----	None	.05
FeO-----	10.64	8.40	H <sub>2</sub> O+-----	3.29	3.37	MnO-----	.14	.14
MgO-----	5.50	8.34	TiO <sub>2</sub> -----	2.57	1.25			
CaO-----	6.30	7.10	CO <sub>2</sub> -----	None	.80		100.05	99.50



## MISCELLANEOUS ROCKS

A-D. Four basaltic rocks collected by F. G. Wells. Analyses by J. J. Fahey, record D-258. See U. S. Geol. Survey Bull. 850, 1934.

A. Norite, Cozad Mountain, Douglas County, sec. 5, T. 24 S., R. 4 W. Labradorite, hypersthene, augite, magnetite, serpentine trace.

B. From Steins Mountain, Lane County, sec. 24, T. 23 S., R. 3 W. Labradorite, augite, hypersthene, magnetite.

C. Diabase dike, Douglas County, sec. 29, T. 24 S., R. 4 W. Labradorite, augite, olivine, chlorite, serpentine, magnetite.

D. Basalt flow, Douglas County, sec. 24, T. 25 S., R. 4 W. Fine-grained rock.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	50.23	53.63	47.90	47.51	H <sub>2</sub> O-.....	0.51	1.10	0.90	2.33
Al <sub>2</sub> O <sub>3</sub> .....	15.85	17.95	13.79	12.81	H <sub>2</sub> O+.....	1.67	1.12	1.13	1.91
Fe <sub>2</sub> O <sub>3</sub> .....	2.95	3.24	5.13	6.28	P <sub>2</sub> O <sub>5</sub> .....	.49	.72	.82	.76
FeO.....	7.22	4.84	8.26	6.86	MnO.....	.12	.11	.16	.19
CaO.....	10.16	7.88	10.69	10.84	Cr <sub>2</sub> O <sub>3</sub> .....	.02	.01	.02	.02
MgO.....	6.84	4.94	6.18	6.58	CO <sub>2</sub> .....	None	None	.14	.05
Na <sub>2</sub> O.....	1.58	2.25	1.73	2.09					
K <sub>2</sub> O.....	.97	1.16	.74	.31					
TiO <sub>2</sub> .....	1.32	.91	2.13	1.75		99.93	99.86	99.74	100.29

E. Granodiorite, collected by G. F. Kay, Riddle quadrangle. Analysis by R. C. Wells, record 2893.

F-G. Two basalts from southern Oregon, collected by Eugene Callaghan. Analyses by J. G. Fairchild, record D-119.

F. From western part of Cascade Range.

G. Younger olivine basalt from a few miles south of Mount Hood.

H. Igneous rock at Hole in the Ground dam site, Owyhee County. Collected by B. C. Renick. Analysis by J. G. Fairchild, record C-626.

	E	F	G	H		E	F	G	H
SiO <sub>2</sub> .....	57.87	57.47	49.85	71.71	TiO <sub>2</sub> .....	1.21	1.60	2.50	0.25
Al <sub>2</sub> O <sub>3</sub> .....	16.76	14.95	15.20	14.49	ZrO <sub>2</sub> .....	.02	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	2.21	2.05	1.69	2.01	CO <sub>2</sub> .....	None	-----	-----	-----
FeO.....	4.60	7.18	10.50	.30	P <sub>2</sub> O <sub>5</sub> .....	.34	.32	.40	( <sup>1</sup> )
MgO.....	3.29	2.74	6.25	.25	MnO.....	.04	.12	.16	-----
CaO.....	6.23	6.63	9.43	2.35	BaO.....	.02	-----	-----	-----
Na <sub>2</sub> O.....	4.07	3.45	3.08	3.84	FeS <sub>2</sub> .....	.23	-----	-----	-----
K <sub>2</sub> O.....	2.17	2.15	.97	4.06					
H <sub>2</sub> O-.....	.32	.45	None	-----		100.29	99.66	100.27	99.26
H <sub>2</sub> O+.....	.91	.55	.24	-----					

<sup>1</sup> Probably contains a very small quantity of P<sub>2</sub>O<sub>5</sub> reported as Al<sub>2</sub>O<sub>3</sub>.

I-K. Three samples of pumice, collected by B. N. Moore. Analyses by J. J. Fahey, record D-114.

I. Sec. 8, T. 27 S., R. 8 E., Willamette meridian, Klamath County.

J. Sec. 30, T. 21 S., R. 13 E., Willamette meridian, Deschutes County.

K. Sec. 17, T. 28 S., R. 8 E., Willamette meridian, Klamath County.

L-O. Four rhyolites from Sumpter quadrangle, collected by J. T. Pardee. Partial analyses by R. C. Wells, record 3053.

L. Kings Mountain.

M. Water Gulch.

N. Minersville.

O. Bridge Creek.

	I	J	K	L	M	N	O
SiO <sub>2</sub> .....	68.56	71.72	69.50	76.12	73.75	75.06	72.92
Al <sub>2</sub> O <sub>3</sub> .....	14.22	13.77	15.18	-----	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	1.42	.55	1.24	-----	-----	-----	-----
FeO.....	1.49	1.34	1.42	-----	-----	-----	-----
MgO.....	.83	.52	.83	-----	-----	-----	-----
CaO.....	2.35	Trace	2.08	.59	.66	.50	.50
Na <sub>2</sub> O.....	5.18	4.54	4.78	4.17	3.17	4.23	3.98
K <sub>2</sub> O.....	2.47	3.75	2.18	3.55	4.63	3.84	3.63
H <sub>2</sub> O.....	3.32	3.22	2.51	-----	-----	-----	-----
TiO <sub>2</sub> .....	.58	.25	.41	-----	-----	-----	-----
CO <sub>2</sub> .....	None	None	None	-----	-----	-----	-----
P <sub>2</sub> O <sub>5</sub> .....	.10	.06	.21	-----	-----	-----	-----
MnO.....	.03	.02	.03	-----	-----	-----	-----
	100.55	99.74	100.37	-----	-----	-----	-----



## PANAMA

Rocks collected by D. F. MacDonald. Analyses A-D by R. C. Wells, record 3116; analyses E and F by R. C. Wells with corrected fluorine determinations by J. G. Fairchild, record 2799. The Cucaracha rocks are described in Nat. Acad. Sci. Mem., vol. 18, pp. 53-68, 1924, and all of them more briefly in U. S. Bur. Mines Bull. 86, 1915.

A. Greenish Cucaracha rock.

B. Red Cucaracha rock.

C. Gatun formation.

D. Gatun soil.

E. Andesite, Point Farfan. Specific gravity, 2.57.

F. Granodiorite, Cocovi Islands. Specific gravity, 2.52.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	53.13	50.44	37.31	35.18	57.39	63.51
Al <sub>2</sub> O <sub>3</sub> .....	16.65	17.82	13.09	28.03	15.84	18.07
Fe <sub>2</sub> O <sub>3</sub> .....	5.19	9.84	5.13	13.47	2.38	2.01
FeO.....	3.11	1.27	1.73	-----	5.96	2.18
MgO.....	1.80	1.25	2.56	.13	2.41	2.19
CaO.....	2.34	1.41	14.86	.50	5.24	5.14
Na <sub>2</sub> O.....	.85	.63	1.05	.21	5.23	4.08
K <sub>2</sub> O.....	.59	.43	.87	.18	.84	.88
H <sub>2</sub> O.....	10.24	9.97	6.99	7.35	1.09	1.07
H <sub>2</sub> O+.....	4.74	5.90	3.59	11.79	1.74	.60
TiO <sub>2</sub> .....	1.04	1.10	.80	1.55	1.35	.33
ZrO <sub>2</sub> .....	Trace	Trace	.02	Trace	Trace	None
CO <sub>2</sub> .....	.43	.10	9.48	.08	Trace	None
P <sub>2</sub> O <sub>5</sub> .....	.06	.04	.08	.02	.68	.19
SO <sub>3</sub> .....	.12	None	2.50	.33	-----	-----
Cl.....	-----	-----	-----	-----	.05	.01
F.....	-----	-----	-----	-----	.07	.06
S.....	-----	-----	-----	-----	.01	.01
Cr <sub>2</sub> O <sub>3</sub> .....	Trace	.04	Trace	Trace	-----	-----
V <sub>2</sub> O <sub>5</sub> .....	Trace	Trace	Trace	.04	Trace	Trace
MnO.....	.05	.02	.24	.02	.18	.06
BaO.....	Trace	-----	-----	-----	.02	.03
C.....	-----	-----	-----	.88	-----	-----
Less O.....	100.34	100.26	100.30	99.76	100.48	100.42
	-----	-----	-----	-----	.03	.03
	-----	-----	-----	-----	100.45	100.39

## PENNSYLVANIA

A-D. Rocks studied by Florence Bascom. Analyses A-C by R. C. Wells, record 3099. D by A. A. Chambers, record 3100.

A. Granite, west end of Furnace Hill, Boyertown quadrangle. Quartz, microcline, micropertthite, biotite, muscovite.

B. Quartz diorite, 0.5 mile northwest of Seisholtzville. Quartz, orthoclase, microcline, albite, oligoclase, biotite, and accessory magnetite, titanite, and apatite.

C. Quartz gabbro, hill 1¼ miles southwest of Blandon. Quartz, labradorite, andesine, augite, hornblende, with accessory biotite, magnetite, apatite, and zircon.

D. Trachyte porphyry, east of Rittenhouse Gap iron mines, Boyertown quadrangle. Orthoclase, a little hornblende, and secondary sericite.

E. Harpers phyllite, 1 mile southeast of Mountville, Lancaster County, collected by E. B. Knopf. Partial analysis by J. G. Fairchild, record C-344.

F-G. Quarryville quadrangle. Two rocks collected by E. B. Knopf. Analyses by R. K. Bailey, record 3265.

F. †Camargo schist.<sup>6</sup> Albite, muscovite, quartz, calcite, tourmaline, titanite.

G. †Camargo schist. Similar to F.

<sup>6</sup> A dagger (†) preceding a geologic name indicates that the name has been abandoned or rejected for use in publications of the U. S. Geological Survey.



	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	73.64	70.54	64.42	63.40	67.38	68.40	54.99
Al <sub>2</sub> O <sub>3</sub> .....	12.82	15.32	17.33	18.30	-----	12.62	18.74
Fe <sub>2</sub> O <sub>3</sub> .....	.65	.87	.59	3.18	-----	1.80	2.90
FeO.....	1.55	1.37	3.72	1.77	-----	2.54	5.49
MgO.....	.12	.52	1.40	.33	-----	1.74	2.81
CaO.....	1.08	3.42	5.53	.70	-----	2.20	.85
Na <sub>2</sub> O.....	2.47	4.52	4.22	6.51	2.18	2.34	1.68
K <sub>2</sub> O.....	6.22	1.58	1.05	5.51	5.79	5.12	5.36
H <sub>2</sub> O.....	.14	.37	.37	.05	-----	1.08	5.10
H <sub>2</sub> O+.....	.68	.51	.53	.86	-----	-----	-----
TiO <sub>2</sub> .....	.17	.32	.46	.10	-----	1.13	1.66
ZrO <sub>2</sub> .....	-----	.03	Trace	-----	-----	-----	-----
CO <sub>2</sub> .....	.38	.24	Trace	Trace	-----	1.34	.18
P <sub>2</sub> O <sub>5</sub> .....	.04	.11	.23	.06	-----	.50	.62
S.....	None	Trace	Trace	-----	-----	-----	-----
MnO.....	.03	.02	.07	.08	-----	.66	.04
BaO.....	.04	.03	.03	Trace	-----	-----	-----
SrO.....	-----	.03	.02	Trace	-----	-----	-----
SO <sub>3</sub> .....	-----	-----	-----	None	-----	-----	-----
	100.03	99.86	99.97	100.85	-----	100.89	100.42

## UTAH

## FAIRFIELD QUADRANGLE

Six volcanic rocks collected and described by James Gilluly in Prof. Paper 173, 1932. Partial analyses by J. G. Fairchild, record C-1017.

A. Biotite-hornblende-augite trachyte, breccia near head of City Canyon. Biotite, augite, magnetite, orthoclase.

B. Augite-biotite-hornblende latite from Oak Canyon. Also contains plagioclase, quartz, and accessory apatite, zircon, and magnetite.

C. Quartz latite from northwest corner sec. 2, T. 5 S., R. 2 W. Biotite, hornblende, plagioclase, quartz.

D. Obsidian, Tickville Gulch. Phenocrysts of plagioclase.

E. Quartz latite, Tickville Spring. Phenocrysts of quartz, plagioclase, biotite, and hornblende.

F. Hypersthene-augite latite from 6,589-foot hill in southwest corner of sec. 8, T. 4 S., R. 2 W. With visible orthoclase.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	62.38	61.09	65.64	72.11	66.90	59.86
CaO.....	5.50	4.70	3.26	.71	2.35	4.62
Na <sub>2</sub> O.....	2.68	3.00	3.26	2.53	3.34	3.31
K <sub>2</sub> O.....	5.08	3.77	3.50	4.78	3.75	4.84

## GOLD HILL QUADRANGLE

Rocks collected by T. B. Nolan. Analyses by J. G. Fairchild, record C-1015.

A. Hypersthene-augite andesite, 0.25 mile west of benchmark 5045 on Deep Creek. Hypersthene, augite, labradorite, hornblende, magnetite, apatite, in glass.

B. Biotite-augite andesite, west of benchmark 5030 on Deep Creek. Minerals similar to A.

C. Biotite latite 0.75 mile southeast of benchmark 5045 on Deep Creek.

D. Trachyte 1 mile east of benchmark 5120 on Deep Creek.

E. Alkali basalt 1,200 feet northeast of benchmark 5509, Overland Canyon.

	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> .....	61.52	57.94	70.30	65.00	47.36	K <sub>2</sub> O.....	3.02	8.90	4.37	5.19	2.66
Al <sub>2</sub> O <sub>3</sub> .....	15.25	16.66	14.92	14.28	-----	H <sub>2</sub> O.....	.36	1.66	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	2.20	2.73	-----	-----	-----	H <sub>2</sub> O+.....	2.23	3.82	-----	-----	-----
FeO.....	3.97	.57	-----	-----	-----	TiO <sub>2</sub> .....	1.00	1.00	-----	-----	-----
MgO.....	2.59	.60	-----	-----	-----	P <sub>2</sub> O <sub>5</sub> .....	.16	.11	-----	-----	-----
CaO.....	5.72	4.91	-----	-----	-----		100.33	100.19	-----	-----	-----
Na <sub>2</sub> O.....	2.31	1.29	2.66	2.23	2.80						



SAN RAFAEL SWELL

Two basic rocks collected by James Gilluly, described in Am. Jour. Sci., 5th ser., vol. 14, p. 199, 1927. Analyses by J. G. Fairchild, record C-908.

A. Analcite diabase, forming part of 80-foot sill, just north of Starvation Wash, T. 26 S., R. 6 E. Augite, thomsonite, biotite, labradorite, olivine, soda orthoclase, amphibole, magnetite-ilmenite, analcite, apatite.

B. Analcite syenite, same locality. Soda orthoclase, amphibole, labradorite, thomsonite, augite, magnetite-ilmenite, biotite, apatite, natrolite.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	44.30	50.01	Na <sub>2</sub> O.....	3.13	4.43	P <sub>2</sub> O <sub>5</sub> .....	0.58	0.67
Al <sub>2</sub> O <sub>3</sub> .....	13.53	17.98	K <sub>2</sub> O.....	2.10	4.82	SO <sub>3</sub> .....	.08	.12
Fe <sub>2</sub> O <sub>3</sub> .....	4.11	3.05	H <sub>2</sub> O.....	.23	.27	Cl.....	.07	None
FeO.....	5.46	3.26	H <sub>2</sub> O+.....	2.19	2.95	MnO.....	.10	.10
MgO.....	10.48	3.13	TiO <sub>2</sub> .....	2.33	2.00			
CaO.....	10.82	7.09	CO <sub>2</sub> .....	.12	.09			
							99.63	99.97

MISCELLANEOUS ROCKS

A-C. Two rocks from Santaquin-Nebo district, collected by G. F. Loughlin and described in Prof. Paper 120, pages 101-109, 1919. Analyses by George Steiger, record 3154.

A. Lamprophyre dike rock. Augite, biotite, olivine, minor magnetite and apatite.

B. Part of A soluble in HCl.

C. Similar rock with a groundmass of albite. Part soluble in HCl.

D-E. Two latites, collected in the Tintic district, and described by Lindgren and Loughlin in Prof. Paper 107, 1919. Partial analyses by George Steiger, record 2993.

D. Dike 1 mile southeast of Pinyon Peak. Plagioclase, biotite, and hornblende, with accessory magnetite and apatite.

E. Volcano Ridge. Plagioclase and augite.

F. Granodiorite (Alta stock) from the Wasatch Mountains, Cottonwood special quadrangle, collected by F. C. Calkins. Analysis by Charles Milton, record D-339. Andesine, quartz, orthoclase, biotite, hornblende, titanite, apatite, magnetite, and traces of chlorite and sericite.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	45.59			57.27	53.75	62.16
Al <sub>2</sub> O <sub>3</sub> .....	12.02	10.13	4.10			17.17
Fe <sub>2</sub> O <sub>3</sub> .....	3.84	7.42	5.31			2.26
FeO.....	5.05					2.78
MgO.....	7.09	4.51	4.22	2.45	3.30	1.81
CaO.....	10.21	5.41	5.52	6.06	5.95	4.70
Na <sub>2</sub> O.....	1.82			2.94	3.18	3.96
K <sub>2</sub> O.....	3.90			3.23	4.13	3.58
H <sub>2</sub> O.....	1.64					.03
H <sub>2</sub> O+.....	3.59					.60
TiO <sub>2</sub> .....	1.67	.95	.51			.53
ZrO <sub>2</sub> .....	None					.01
CO <sub>2</sub> .....	1.91	1.91				None
P <sub>2</sub> O <sub>5</sub> .....	1.33					.17
S.....	.13					.04
MnO.....	.16					.06
BaO.....	.20					.17
SrO.....	.16					
	100.31					100.03
Specific gravity.....	2.755		2.680			

VIRGINIA

A-G. Seven samples of soapstone and chloritic schist sent in by Scott Turner. Mineral analysis by W. T. Schaller, record D-149.

A-E. From Virginia Alberene Corporation, Schuyler.

F-G. From Lynchburg.



	A	B	C	D	E	F	G
Talc.....	15	20	35	5	50	-----	-----
Actinolite.....	25	5	5	15	5	75	70
Chlorite.....	50	35	35	65	20	20	25
Calcite.....	3	30	20	5	20	-----	-----
Iron oxide.....	2	8	5	8	5	3	2
Other material.....	5	2	-----	2	-----	2	3
	100	100	100	100	100	100	100

H. Emery ore rock 1½ miles west of Whittles station, Pittsylvania County, collected by T. L. Watson. Analysis by George Steiger, record 3197. This rock has also been termed "spinellite" and consists chiefly of an aggregate of corundum, magnetite, spinel, and ilmenite. It is described by Watson and Steiger in Washington Acad. Sci. Jour., vol. 8, pp. 665-670, 1918. Zr, P, S, Ba, Sr absent.

I-J. Two altered gangue rocks with an ilmenite vein near Bedford, collected by C. S. Ross. Analyses by J. G. Fairchild, record D-286. I, Feldspar partly altered to muscovite; J, feldspar partly altered to zoisite.

K. Manganese ore near Suiter, collected by H. D. Miser. Partial analysis by J. G. Fairchild, record C-240.

	H	I	J	K		H	I	J	K
SiO <sub>2</sub> .....	2.53	60.30	59.62	-----	TiO <sub>2</sub> .....	3.72	0.05	0.09	-----
Al <sub>2</sub> O <sub>3</sub> .....	45.38	24.06	24.06	-----	CO <sub>2</sub> .....	.07	Trace	Trace	-----
Fe <sub>2</sub> O <sub>3</sub> .....	23.33	.15	.49	-----	Cr <sub>2</sub> O <sub>3</sub> .....	.05	-----	-----	-----
FeO.....	17.90	.05	.09	-----	NiO.....	.04	-----	-----	-----
MgO.....	5.71	.07	.07	-----	MnO.....	.15	-----	-----	72.37
CaO.....	.06	5.42	4.54	-----	BaO.....	-----	-----	-----	Present
Na <sub>2</sub> O.....	.20	5.88	5.36	-----	Available O.....	-----	-----	-----	15.67
K <sub>2</sub> O.....	None	3.57	4.84	-----					
H <sub>2</sub> O.....	.33	-----	.03	0.04					
H <sub>2</sub> O+.....	.99	.78	1.19	2.56		100.46	100.33	100.38	90.64

## ANALYSES OF SANDSTONES AND CHERTS

### ARIZONA

Glauconitic sandstone, Grand Canyon. Partial analyses by Chase Palmer, record 2951.

	A	B
Fe <sub>2</sub> O <sub>3</sub> .....	8.68	13.12
FeO.....	1.00	1.41
K <sub>2</sub> O.....	3.30	5.72
Na <sub>2</sub> O.....	.18	.64

### CALIFORNIA

"Oil sands." Analyses by George Steiger, record D-54-a.

A. Oil sand in Temblor formation, Milborn-Kennedy well 1, sec. 28, T. 21 S., R. 17 E. Portion passing 300-mesh sieve.

B. Same as A. Portion not passing 300-mesh sieve.

C. Bolsa Chica oil sand, Kettleman Hills, King County, sec. 24, T. 22 S., R. 17 E. Depth, 7,670 feet.



	A	B	C			
			Soluble in cold 1-10 HCl	Soluble in hot 1-10 HCl	Insoluble in 1-10 HCl	Determi- nation made on original rock
SiO <sub>2</sub> .....	59.16	72.48	0.08	1.24	44.91	-----
Al <sub>2</sub> O <sub>3</sub> .....	14.03	7.69	1.00	1.15	14.70	-----
Fe <sub>2</sub> O <sub>3</sub> .....	2.26	1.36	3.17	2.22	.97	-----
FeO.....	2.68	1.88	-----	-----	-----	-----
MgO.....	5.20	6.76	1.95	.80	.95	-----
CaO.....	2.68	1.46	4.71	.28	1.33	-----
Na <sub>2</sub> O.....	2.36	1.76	-----	-----	-----	0.50
K <sub>2</sub> O.....	2.14	1.72	-----	-----	-----	3.80
H <sub>2</sub> O.....	2.50	1.34	-----	-----	-----	5.78
H <sub>2</sub> O+.....	3.28	2.44	-----	-----	-----	-----
TiO <sub>2</sub> .....	.61	.23	None	None	.97	-----
CO <sub>2</sub> .....	.33	.25	1.98	7.66	-----	-----
P <sub>2</sub> O <sub>5</sub> .....	.49	.22	-----	-----	-----	-----
SO <sub>3</sub> .....	.80	.31	-----	-----	-----	-----
S <sup>1</sup> .....	1.25	.06	-----	-----	-----	-----
MnO.....	.03	.03	-----	-----	-----	-----
	99.80	99.99	12.89	13.35	63.83	10.08
			100.15			

<sup>1</sup> Pyrite is present in small quantity. Sulphur probably present as an organic compound. M. N. Short estimates pyrite as less than 0.1 percent.

## NEVADA

A sample of chert collected by S. H. Cathcart from Triassic strata on Pilot Mountain, just east of Mina, representing several thousand feet. Secondary silica with accessory plagioclase, sericite, epidote, zircon, apatite, rutile, and calcite. Analysis by J. G. Fairchild, record C-521.

SiO <sub>2</sub> .....	95.84	K <sub>2</sub> O.....	0.36
Al <sub>2</sub> O <sub>3</sub> , ZrO <sub>2</sub> , P <sub>2</sub> O <sub>5</sub> .....	1.97	Na <sub>2</sub> O.....	.14
Fe <sub>2</sub> O <sub>3</sub> , FeO.....	.70	TiO <sub>2</sub> .....	.13
CaO.....	.37		
MgO.....	.12		99.63

## NEW MEXICO

Two samples studied by B. C. Renick with reference to ground waters. Determination of minor constituents by J. G. Fairchild, record C-668.

A. Poleo sandstone from ravine 1 mile west of Miller ranch, San Ysidro, Sandoval County.

B. Massive red sandstone below Poleo sandstone and above the scarlet red member. From mesa east of Jemez Creek and 2 miles south of junction of San Diego and Guadalupe Canyons, Sandoval County.

	Percent soluble in 1-1 HCl			Percent soluble in 1-1 HCl	
	A	B		A	B
(Fe,Al) <sub>2</sub> O <sub>3</sub> .....	0.19	0.78	SO <sub>3</sub> .....	0.12	0.01
CaO.....	.13	.17	Soluble in boiling 5 percent solution of Na <sub>2</sub> CO <sub>3</sub> .....	.12	.50
MgO.....	.03	.05			
(Na,K) <sub>2</sub> O.....	.07	.06			



## OKLAHOMA

A-F. Oil sands submitted by A. F. Melcher. Analyses by E. P. Henderson, record C-394.

- A. Waite Phillips well 1.  
 B. Sinclair well 2.  
 C. Carter well 4.  
 D. Waite Phillips well 5.  
 E. Phillips Skilly well 4.  
 F. Producers & Refiners well 6.

	A	B	C	D	E	F
Insoluble in HCl.....	83.52	83.90	85.82	86.65	72.95	82.95
R <sub>2</sub> O <sub>3</sub> <sup>1</sup> .....	9.45	7.12	4.67	7.77	3.20	7.58
CaO.....	.15	.45	.26	.10	10.70	.19
MgO.....	.88	.57	.53	.66	.75	.39
CO <sub>2</sub> .....					8.38	
	94.00	92.04	91.28	95.18	95.98	91.11

<sup>1</sup> Including FeO weighed as Fe<sub>2</sub>O<sub>3</sub>.

G-L. Whitehorse sandstone from Cement oil field. Collected by Frank Reeves and described in Bull. 726, pp. 51-56, 1922. Determinations by R. C. Wells, record C-213, to see if color could be related to the iron content.

- G. Brick red.  
 H. Gray with purple cast.  
 I. Very light brick red.  
 J, K. Light straw.  
 L. White.

	G	H	I	J	K	L
Insoluble in hot 1-1 HCl.....	92.15	94.85	94.89	94.81	94.85	58.79
Soluble in hot 1-1 HCl:						
Fe <sub>2</sub> O <sub>3</sub> .....	1.76	.98	1.02	.97	1.08	.24
MnO.....	.02	.01				
CaO.....	.26	.38	.30	.30	.22	12.21
MgO.....	1.68	.47	.62	.66	.58	8.52
Soluble in cold 1-1 HCl in 2 hours: Fe <sub>2</sub> O <sub>3</sub> .....	.24	.16	.34	.31	.29	.18
Percentage of total Fe <sub>2</sub> O <sub>3</sub> dissolved by 2-hour treatment.....	.14	16.00	33.00	32.00	27.00	75.00
FeO (by usual hydrofluoric method).....	.05	.02			Trace	.03

## OREGON

Sixteen samples of diatomite submitted by R. W. Richards. Analyses by E. T. Erickson, record D-82.

- A. Clover Creek, sec. 11, T. 18 S., R. 42 E., Baker County.  
 B. Klamath Falls, sec. 12, T. 39 S., R. 8 E., Klamath County.  
 C. Sycan River, sec. 5, T. 36 S., R. 14 E., Klamath County.  
 D. Sprague River, sec. 12, T. 26 S., R. 10 E., Klamath County.  
 E. Poe Valley, sec. 25, T. 40 S., R. 11 E., Klamath County.  
 F. Drewsey, sec. 34, T. 19 S., R. 36 E., Harney County.  
 G, H. Drewsey, sec. 14, T. 20 S., R. 36 E., Harney County.  
 I. Harper, sec. 14, T. 19 S., R. 41 E., Malheur County.  
 J. Westfall, sec. 15, T. 18 S., R. 41 E., Malheur County.  
 K. Harper, sec. 34, T. 19 S., R. 42 E., Malheur County.  
 L. Harper, sec. 34, T. 18 S., R. 41 E., Malheur County.  
 M. Harper, sec. 2, T. 19 S., R. 41 E., Malheur County.  
 N. Harper, sec. 11, T. 19 S., R. 41 E., Malheur County.  
 O. Harper, sec. 22, T. 19 S., R. 42 E., Malheur County.  
 P. Terrebonne, sec. 16, T. 14 S., R. 12 E., Jefferson County.



	A	B	C	D	E	F	G	H
SiO <sub>2</sub> .....	72.50	75.56	76.00	65.52	75.30	84.48	81.68	82.78
Al <sub>2</sub> O <sub>3</sub> .....	9.93	8.54	5.90	14.44	8.42	3.66	5.93	4.61
Fe <sub>2</sub> O <sub>3</sub> .....	4.58	2.66	2.03	3.34	2.89	1.46	1.20	1.77
CaO.....	.60	1.20	.38	1.56	1.90	.80	.54	.44
MgO.....	.54	.37	.23	.87	.63	.18	.30	.22
Na <sub>2</sub> O.....	.33	1.08	.33	.91	.71	.22	.24	.62
K <sub>2</sub> O.....	.16	.26	.15	.42	.32	.16	.10	.24
TiO <sub>2</sub> .....	.45	.64	.13	.86	.45	.26	.31	.26
SO <sub>3</sub> .....	.03	.06	.17	.03	.03	.06	.05	.15
Cl.....	.04	None	.06	.10	.34	.05	None	None
CO <sub>2</sub> .....	.09	.11	.20	.04	.10	.05	.09	.06
Loss at 105° C. (24 hours).....	4.78	3.76	5.20	5.20	3.80	4.90	4.62	4.74
Additional loss in Meeker burner flame (3 minutes).....	5.83	5.40	9.18	7.40	5.67	4.24	5.10	4.78
	99.86	99.64	99.96	100.69	100.56	100.53	100.16	100.67

  

	I	J	K	L	M	N	O	P
SiO <sub>2</sub> .....	77.96	83.82	74.78	82.64	85.52	78.12	82.84	83.18
Al <sub>2</sub> O <sub>3</sub> .....	3.93	3.74	6.69	3.20	2.60	6.29	3.18	2.66
Fe <sub>2</sub> O <sub>3</sub> .....	2.92	1.99	1.98	1.88	1.04	1.88	1.14	1.46
CaO.....	1.26	.58	.88	.64	.48	.96	.38	.80
MgO.....	.67	.30	.65	.38	.17	.41	.23	.35
Na <sub>2</sub> O.....	.98	.34	1.44	.04	.28	.34	1.12	.48
K <sub>2</sub> O.....	.16	.20	.32	.14	.04	.20	.14	.14
TiO <sub>2</sub> .....	.27	.19	.27	.18	.14	.33	.18	.16
SO <sub>3</sub> .....	.10	.12	.88	.06	.09	.04	.69	.10
Cl.....	.02	None	1.66	None	None	None	.18	.02
CO <sub>2</sub> .....	.15	.09	.13	.09	.14	.13	.05	.08
Loss at 105° C. (24 hours).....	6.22	3.72	6.48	4.92	4.72	4.72	5.68	6.28
Additional loss in Meeker burner flame (3 minutes).....	6.16	5.06	6.56	5.40	4.44	6.80	5.52	4.50
	100.80	100.15	102.72	99.57	99.66	100.22	101.33	100.21

## UTAH

A-R. Eighteen sandstones tested for uranium and vanadium. A to G, Crescent Creek, Henry Mountains; H and I, Park Creek, La Sal Mountains; J and K, Trachyte Creek, Henry Mountains; L to R, Browns Park, San Rafael Swell. Analyses A to F by R. C. Wells, record 2885; G to K by Chase Palmer, record 2887; L to R by George Steiger, record 2889. No selenium except 0.01 percent in E and M and 0.03 percent in Q.

	V <sub>2</sub> O <sub>5</sub>	UO <sub>3</sub>			V <sub>2</sub> O <sub>5</sub>	UO <sub>3</sub>	
		Gravimetric	Electroscopic			Gravimetric	Electroscopic
A.....	2.29	0.47	0.38	J.....	3.59	0.33	-----
B.....	.09	None	.11	K.....	1.04	.43	-----
C.....	.24	.11	.09	L.....	2.90	.06	-----
D.....	4.65	.14	.09	M.....	6.69	3.19	-----
E.....	.11	None	.03	N.....	None	None	-----
F.....	.24	None	.03	O.....	4.02	None	-----
G.....	.04	.04	-----	P.....	.30	None	-----
H.....	.07	.02	-----	Q.....	11.13	.03	-----
I.....	.05	.09	-----	R.....	.20	None	-----

S-V. Molybdenum-bearing sandstone from Ouray, described by F. L. Hess in Bull. 750, pp. 3-8, 1925. Analyses by W. T. Schaller, record C-246.

S. Sandstone richest in soluble salts.

T. Same after deducting insoluble.

U. Pale-blue fibers.

V. Same after deducting insoluble.



	S	T	U	V		S	T	U	V
Insoluble in water	81.79	-----	7.06	-----	MgO	0.14	0.78	1.54	1.66
MoO <sub>3</sub> <sup>a</sup>	.70	3.83	2.06	2.22	SO <sub>3</sub>	5.29	29.04	25.09	27.00
Al <sub>2</sub> O <sub>3</sub>	1.13	6.18	3.07	3.30	H <sub>2</sub> O <sup>c</sup>	9.31	51.13	50.23	54.04
FeO <sup>b</sup>	1.62	8.88	10.95	11.78					
MnO	.01	.07	-----	-----		100.00	100.00	100.00	100.00
NiO	.01	.09	-----	-----					

<sup>a</sup> Total molybdenum as MoO<sub>3</sub>.<sup>b</sup> Total iron as FeO.<sup>c</sup> By difference.

## VIRGINIA

Matrix of sandstone from Quantico, collected by G. F. Loughlin. Tests of "soluble silica" by J. G. Fairchild, record C-393.

A. Amorphous matrix, soluble in 10 percent NaOH, 22.8.

B. Partly crystalline matrix, soluble in 5 percent Na<sub>2</sub>CO<sub>3</sub>, 3.2.

## WEST VIRGINIA

Big Injun oil sand from Clifton Oil & Gas Co., Mannington. Examined by P. G. Nutting. Portion soluble in acid analyzed by J. G. Fairchild, record C-965.

SiO <sub>2</sub>	0.97	MgO	0.42
Al <sub>2</sub> O <sub>3</sub>	1.72	CaO	1.15
FeO	3.63		

## ANALYSES OF CARBONATE ROCKS

## ALABAMA

A-B. Two samples of marble near Sylacauga, collected by T. N. Dale. Analyses by Chase Palmer, record 3195.

A. Cream-colored. Very minute grains of pyrrhotite or pyrite.

B. Very little dolomite, quartz, pyrite, muscovite, and undetermined opaque specks.

C-D. Two samples of Bangor limestone from the DeBardeleben mine of the Alabama Fuel & Iron Co., Russellville district, Franklin County. Analyses by J. J. Fahey, record D-345. Sample D appears to be slightly weathered.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub>	0.67	-----	6.00	5.98	K <sub>2</sub> O	0.27	-----	0.38	0.34
Al <sub>2</sub> O <sub>3</sub>	.16	-----	1.68	1.83					
Fe <sub>2</sub> O <sub>3</sub>	-----	.52	.50	.41	CO <sub>2</sub>	43.47	41.89	39.49	39.16
FeO	.04	.04	.35	.33	S	.02	-----	-----	-----
CaO	53.32	52.53	49.58	49.60	TiO <sub>2</sub>	-----	-----	.10	.08
MgO	1.77	1.53	.95	.98	C	.01	-----	-----	-----
H <sub>2</sub> O	-----	-----	1.49	1.50	Insoluble	-----	2.66	-----	-----
MnO	None	None	-----	-----		99.73	99.17	100.54	100.24

## ALASKA

A-L. Dolomitic rocks from the pre-Cambrian of central Alaska, collected by J. B. Mertie, Jr., and described in Bull. 836, pp. 369-392, 1933. Analyses by J. G. Fairchild, record D-31.

	A	B	C	D	E	F	G
SiO <sub>2</sub>	4.74	27.77	30.39	37.31	31.06	26.42	29.30
CaO	48.70	20.33	19.78	8.36	19.17	21.94	25.88
MgO	2.93	12.80	13.03	6.97	12.88	14.03	7.49
Ignition	41.21	30.85	29.61	19.24	29.34	32.84	27.55
	97.58	91.75	92.81	71.88	92.15	95.23	90.22



	H	I	J	K	L
SiO <sub>2</sub> .....	54.80	71.66	35.97	43.24	10.52
Fe <sub>2</sub> O <sub>3</sub> .....	26.68	3.84	5.07	5.34	-----
CaO.....	4.85	9.90	24.81	21.07	27.27
MgO.....	2.66	1.45	1.98	2.07	18.46
Ignition.....	6.32	9.66	23.41	17.47	21.62
	95.31	96.51	91.24	89.19	97.87

M-P. Four limestones from the Yukon-Tanana district, collected by Eliot Blackwelder. Partial analyses by A. A. Chambers, record 3092.

	M	N	O	P
CaCO <sub>3</sub> .....	44.08	26.07	90.34	98.16
MgCO <sub>3</sub> .....	19.50	20.02	.97	1.22

Q-GG. Seventeen samples of marble from southeastern Alaska, collected by E. F. Buchard and described in U. S. Geol. Survey Bull. 682, 1920. Analyses by R. K. Bailey, record 2952. The carbonates are calculated from CaO and MgO, respectively. In sample FF, however, the loss on ignition was only 36.82 and SiO<sub>2</sub> + R<sub>2</sub>O<sub>3</sub> was 9.71.

- Q, R. Tokeen, Marble Island.
- S, T. One and one-half miles south of Tokeen.
- U, V. West side of Orr Island.
- W. North side of Heceta Island.
- X, Y. Dickman Bay, Prince of Wales Island.
- Z. Waterfall Bay, Dall Island.
- AA. Mill Creek Lake, east of Wrangell.
- BB. Head of Red Bay, Prince of Wales Island.
- CC. South of Sandy Cove, Glacier Bay.
- DD-FF. Admiralty Island, near Marble Cove, Chatham Strait.
- GG. Basket Bay, Chichagof Island.

Mark	Insoluble in HCl	CaCO <sub>3</sub>	MgCO <sub>3</sub>	Mark	Insoluble in HCl	CaCO <sub>3</sub>	MgCO <sub>3</sub>
Q.....	0.01	99.59	0.94	Z.....	0.32	99.59	1.03
R.....	.20	81.90	14.93	AA.....	19.06	53.69	26.10
S.....	20.77	78.65	1.87	BB.....	1.70	96.90	2.59
T.....	7.82	91.70	1.21	CC.....	2.56	96.19	.89
U.....	2.95	95.35	2.04	DD.....	.91	61.11	39.10
V.....	3.50	95.99	1.40	EE.....	3.61	95.44	1.45
W.....	13.18	84.46	2.85	FF.....	-----	59.97	39.90
X.....	22.84	74.61	3.25	GG.....	28.19	63.68	8.90
Y.....	37.32	58.40	6.61				

HH-KK. Four limestones collected by A. F. Buddington, described in Bull. 783, p. 61, 1926. Analyses by J. G. Fairchild, record C-630.

	HH	II	JJ	KK		HH	II	JJ	KK
CaO.....	49.07	54.22	55.41	55.52	Insoluble.....	10.91	2.79	0.12	0.37
MgO.....	.40	.30	.48	.30		99.75	100.24	100.12	100.12
CO <sub>2</sub> (calculated).....	38.96	42.93	44.11	43.93					
(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	.41	None	None	None					



## ARIZONA

A-J. Ten samples of limestone from the Grand Canyon, collected by L. F. Noble and described in Prof. Paper 131, pp. 39-71, 1923. Analyses by A. A. Chambers, record 3123. F, Bright Angel quadrangle; all others Shinumo quadrangle.

	A	B	C	D	E	F	G	H	I	J
Insoluble.....	2.66	23.46	1.52	10.96	24.41	0.47	0.82	0.48	11.15	6.98
R <sub>2</sub> O <sub>3</sub> .....	5.44	2.54	.80	2.89	1.53	.41	.40	.10	.71	.56
CaO.....	29.54	48.25	30.10	27.43	22.95	31.79	32.54	55.50	48.68	29.98
MgO.....	18.26	Trace	20.78	17.88	15.01	19.65	19.52	.08	None	18.68

K-M. Samples of limestone analyzed on account of their relation to the development of ores.

K. Limestone, closely associated with asbestos, Ash Creek mine, 0.5 mile west of Chrysofile, collected by J. S. Diller. Analysis by J. G. Fairchild, record 3262.

L. Limestone from Bisbee, collected by D. F. Hewett. Analysis by J. G. Fairchild, record C-1038.

M. Altered limestone, same locality as L.

	K	L	M		K	L	M
Insoluble.....	1.00	1.35	5.24	MnO.....	-----	0.13	1.15
FeO.....	-----	None	None				
MgO.....	22.80	.52	14.27		99.50	99.74	100.58
CaO.....	36.30	54.37	35.62	MnO <sub>2</sub> in insoluble.....	-----	-----	1.10
H <sub>2</sub> O.....	9.40	-----	-----				
CO <sub>2</sub> .....	30.00	43.37	44.30				

## ARKANSAS

## BATESVILLE DISTRICT

A-E. Manganiferous limestone collected by H. D. Miser. Determinations by Chase Palmer, record C-110.

A. Fernvale limestone 3 miles north of Batesville. MnO, 2.16.

B. Same, 6 miles northeast of Batesville. MnO, 1.91.

C. Same, 5 miles northeast of Batesville. MnO, 7.52.

D. Lower part of St. Clair limestone, 3 miles northeast of Batesville. MnO, 1.97.

E. Red "buttons" in green Cason shale, 3 miles northeast of Batesville. BaO, 0.66.

F-I. Four rocks associated with manganese ore (see also hausmannite) collected by H. D. Miser and described in Bull. 734, 1923. Analyses by R. C. Wells, record 3231. Ba, SO<sub>4</sub>, and CO<sub>2</sub> present but not determined.

F. Pebble-like *Girvanella* in St. Clair limestone.

G. Carbonate core in a manganese boulder, Fernvale limestone, Harvey mine.

H. "Button" from Cason shale, Cason mine.

I. Cason shale, Cason mine.

	F	G	H	I		F	G	H	I
SiO <sub>2</sub> .....	0.29	1.51	2.75	32.75	MgO.....	0.87	0.96	1.45	3.38
Al <sub>2</sub> O <sub>3</sub> .....	4.06	2.06	5.68	8.22	CaO.....	42.80	10.60	29.85	14.22
Fe.....	1.56	6.54	3.08	4.98	Mn.....	5.94	35.50	5.85	5.87

J-P. Samples of rhodochrosite from the Batesville district collected by H. D. Miser and D. F. Hewett. Analyses by R. C. Wells, record D-169.

J-N. From an enriched manganese-bearing lens in the Fernvale limestone.

O, P. From the limestone itself.



	J	K	L	M	N	O	P
Insoluble in 1-2 HNO <sub>3</sub> .....	0.4	4.6	3.7	0.6	2.4	0.9	2.2
Soluble:							
CO <sub>2</sub> .....	39.6	35.7	35.8	37.8	37.0	42.2	41.2
P <sub>2</sub> O <sub>5</sub> .....	.1	.5	.5	.5	.8	.6	.1
FeO.....	.1	.3	.3	.1	.2	1.3	1.0
MnO.....	45.2	49.2	49.1	52.8	45.5	5.9	1.8
CaO.....	13.8	7.9	8.2	7.9	11.6	47.3	51.2
MgO.....	1.5	.6	.4	.3	1.7	1.0	1.0
SiO <sub>2</sub> .....	.1	-----	.2	.2	.3	.2	-----
H <sub>2</sub> O.....	-----	.7	.6	-----	-----	.2	.1
O.....	-----	-----	.6	-----	-----	-----	-----
	100.8	99.5	99.4	100.2	99.5	99.6	98.6

## AUSTRALIA

Samples from Torres Straits, Murray Island, Australia, submitted by T. W. Vaughan. Analyses by A. A. Chambers, record 3080.

A-E. Reef samples near the water line.

F. Reef material, 500-700 feet above sea level.

	A	B	C	D	E	F
Ignition.....	44.89	44.51	44.87	44.96	45.24	43.86
SiO <sub>2</sub> .....	.23	.31	.09	.07	.22	.16
(Al, Fe) <sub>2</sub> O <sub>3</sub> .....	.35	.30	.21	.10	.26	.27
CaO.....	50.80	51.54	50.86	51.41	49.80	55.35
MgO.....	2.69	2.58	2.75	2.68	3.49	.28
SO <sub>3</sub> .....	Trace	Trace	Trace	Trace	Trace	None
Na+K.....	Trace	Trace	Trace	Trace	Trace	(?)
	98.96	99.24	98.78	99.22	99.01	99.92

No P<sub>2</sub>O<sub>5</sub> in any.

## BAHAMAS

A. Composite bottom sample from Andros Island. Analysis by A. A. Chambers, record 3083.

B. Bottom mud submitted by T. W. Vaughan. Analysis by E. T. Erickson, record C-306.

C-F. Composite samples studied by M. I. Goldman. Partial analyses by J. G. Fairchild, record C-397.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	0.09	0.22	Trace	0.10	0.10	0.13
Soluble SiO <sub>2</sub> .....	-----	-----	Trace	Trace	Trace	Trace
Al <sub>2</sub> O <sub>3</sub> .....	-----	.21	-----	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	.08	.06	None	None	None	None
MgO.....	2.43	.66	2.95	2.70	2.70	2.46
CaO.....	51.56	50.19	51.60	51.68	51.68	51.78
H <sub>2</sub> O.....	-----	.79	-----	-----	-----	-----
Organic matter and H <sub>2</sub> O+.....	-----	5.86	-----	-----	-----	-----
TiO <sub>2</sub> .....	-----	None	-----	-----	-----	-----
CO <sub>2</sub> .....	-----	40.60	-----	-----	-----	-----
P <sub>2</sub> O <sub>5</sub> .....	None	Trace	None	None	None	None
SO <sub>3</sub> .....	Trace	.51	Trace	Trace	Trace	Trace
MnO.....	-----	Trace	-----	-----	-----	-----
SrO.....	-----	.63	-----	-----	-----	-----
Ignition.....	44.84	-----	-----	-----	-----	-----
	99.00	99.73	-----	-----	-----	-----

G. Calcareous mud collected by T. W. Vaughan. Determinations of organic matter other than carbonates by E. T. Erickson, record C-287.

Total organic carbon.....	0.65
Nitrogen.....	.07
Phosphorus.....	.01
Stabilized organic carbon insoluble in acids.....	.19
Stabilized organic hydrogen insoluble in acids.....	.03



## CALIFORNIA

## IVANPAH QUADRANGLE

Two samples of dolomite from thin beds in Lower Cambrian quartzite, collected by D. F. Hewett. They weather a chocolate brown. Analyses by J. G. Fairchild, record C-624.

	A	B		A	B		A	B
C O .....	15.55	28.44	MnO .....	0.18	1.03	Insoluble .....	54.92	6.27
MgO .....	6.86	17.18	CO <sub>2</sub> (calculated) ..	20.25	43.74			
FeO .....	.72	3.25	Fe <sub>2</sub> O <sub>3</sub> .....	.64	.28		99.12	100.19

## MISCELLANEOUS ROCKS

Magnesite rock collected by R. W. Stone. Analyses by Chase Palmer, record 3221.

- A, B. Austin Creek, Sonoma County.  
 C. Pope Valley, Napa County.  
 D, E. Red Mountain, Santa Clara County.  
 F. Red Mountain, Stanislaus County.  
 G. Same, calcined.  
 H. Same as D, calcined.  
 I, J. Madrone station, Santa Clara County.  
 K. Sampson Peak, San Benito County.  
 L. Same, calcined.  
 M. Chiles Valley, Napa County.  
 N, O. Soda Valley, Napa County.  
 P, Q. Pope Valley, Napa County.  
 R. Cedar Mountain, Santa Clara County.  
 S. Morgan Hill, Santa Clara County.  
 T. Evergreen, Santa Clara County.  
 U. Red Mountain, Santa Clara County.  
 V. Gilliam Creek, Sonoma County.

	A	B	C	D	E	F	G	H	I	J	K
SiO <sub>2</sub> .....	15.24	8.87	1.94	0.78	2.70	1.67	0.51	0.50	0.65	6.37	5.65
FeO .....	1.17	.88	1.49	.23	.23	.31	1.39	1.43	.33	.35	<sup>1</sup> 1.82
CaO .....	1.15	.43	.67	2.06	.80	1.17	2.49	4.90	2.65	2.88	2.34
MgO .....	40.80	43.18	45.01	45.90	46.02	45.75	90.31	83.17	45.43	41.55	89.08
CO <sub>2</sub> .....	41.02	46.31	50.65	51.68	50.32	50.95	5.22	11.34	51.42	49.18	1.65
	99.38	99.67	99.76	100.65	100.07	99.85	98.92	100.34	100.48	100.33	100.54

  

	L	M	N	O	P	Q	R	S	T	U	V
SiO <sub>2</sub> .....	0.18	4.35	13.90	14.39	2.26	2.43	9.57	2.40	12.05	1.82	2.57
FeO .....	.93	1.71	.70	1.33	2.11	2.40	1.00	1.44	2.83	.60	.89
CaO .....	.90	2.11	.71	.76	1.52	1.57	2.83	3.68	1.98	1.85	.80
MgO .....	46.20	42.62	40.73	39.56	44.10	43.62	42.48	42.56	38.88	45.12	45.65
CO <sub>2</sub> .....	51.86	49.05	44.63	43.65	50.18	50.11	44.70	49.94	44.94	50.73	50.33
	100.07	99.84	100.67	99.69	100.17	100.13	100.58	100.02	100.68	100.02	100.24

<sup>1</sup>Fe<sub>2</sub>O<sub>3</sub>.

- W-DD. Magnesite rock. Analyses by Chase Palmer, record 3228.  
 W, X. Austin Creek, Sonoma County.  
 Y, Z. Soda Valley, Napa County.  
 AA. Calcined. Sampson Peak, San Benito County.  
 BB. Same, crude.  
 CC. Red Mountain, Stanislaus County.  
 DD. White Queen mine, Santa Clara County.

	W	X	Y	Z	AA	BB	CC	DD
SiO <sub>2</sub> .....	14.72	8.73	12.65	13.88	5.21	1.10	0.51	0.50
FeO .....	1.35	.97	.80	1.49	1.70	.72	.57	.20
CaO .....	.64	.39	.95	.27	2.18	1.17	2.48	1.92
MgO .....	39.60	43.18	40.73	39.60	89.08	45.64	90.30	45.90
CO <sub>2</sub> .....	43.73	46.31	44.64	44.62	1.65	51.20	5.22	51.68
	100.04	99.58	99.77	99.86	99.82	99.83	99.08	100.20



EE-KK. Samples of magnesian dolomite from the Mojave River Canyon between Afton and Baxter, collected by W. W. Rubey. Partial analyses by J. G. Fairchild, record D-325.

	EE	FF	GG	HH	II	JJ	KK
Insoluble.....	12.21	7.29	14.40	17.46	26.40	16.65	5.13
CaO.....	24.39	7.83	11.07	6.57	14.52	4.68	28.32
MgO.....	20.55	35.59	29.51	30.92	19.98	33.53	20.30

COLORADO

A, B. Dolomite (blue limestone) from Leadville, unaltered, collected by G. F. Loughlin and described in Prof. Paper 148, 1927. Analysis by J. G. Fairchild, record C-461. A, Soluble in 1-3 HCl; B, insoluble.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	0.04	0.19	H <sub>2</sub> O+.....	0.18	Trace	Organic matter..	0.26	None
Al <sub>2</sub> O <sub>3</sub> .....	.06	.15	P <sub>2</sub> O <sub>5</sub> .....	Trace	Trace	TiO <sub>2</sub> .....	Trace	None
Fe <sub>2</sub> O <sub>3</sub> .....	None		SO <sub>3</sub> .....	.03	Trace	Na <sub>2</sub> O.....	Trace	} 0.11 (1)
FeO.....	.27	H <sub>2</sub> S.....	None	Trace	K <sub>2</sub> O.....	Trace		
MgO.....	21.23	MnO.....	Trace	Trace	FeS <sub>2</sub> .....	Trace		
CaO.....	30.64	ZnO.....	None	Trace				
CO <sub>2</sub> .....	46.88	Cl.....	.08	Trace				
H <sub>2</sub> O-.....	None	F.....	None	Trace				
							99.67	.45

<sup>1</sup> Not detected.

C. Limestone from Quarry Canyon near Manitou, collected by K. C. Heald in studies of oil-yielding limestones. Analysis by E. T. Erickson, record C-304.

D. Dolomite from Weber (?) formation of Mosquito Range, Lake County, collected by Charles H. Behre, Jr. Analysis by J. G. Fairchild, record D-163. The insoluble appears to be claylike material.

E. Timpas limestone, Granada. Analysis by W. C. Wheeler, record 2974.

F. Dolomitic limestone from Alma district, collected by Q. D. Singewald. Analysis by J. J. Fahey, record D-213.

G. Limestone from Aspen, collected by D. F. Hewett.

H. Same limestone altered. Analyses by J. G. Fairchild, record C-1038.

I. Marlstone from Green River formation in valley of Cathedral Creek, sec. 26, T. 3 S., R. 99 W., Rio Blanco County. Submitted by W. H. Bradley. Partial analysis by J. G. Fairchild, record C-1105.

	C	D	E	F	G	H	I
SiO <sub>2</sub> .....	0.14	1.78	4.36	12.1	1.29	1.21	-----
Al <sub>2</sub> O <sub>3</sub> .....	.29	-----	} 1.88	} 1.8	None	1.46	1.75
Fe <sub>2</sub> O <sub>3</sub> .....	-----	1.84					
FeO.....	.04	-----	.34	17.1	.05	18.42	14.88
MgO.....	5.71	19.85	51.71	26.7	54.45	32.08	26.05
CaO.....	48.72	29.83	-----	-----	-----	-----	-----
H <sub>2</sub> O.....	.04	.09	-----	-----	-----	-----	-----
Organic matter.....	.36	-----	-----	-----	-----	-----	-----
TiO <sub>2</sub> .....	Trace	-----	-----	-----	-----	-----	-----
CO <sub>2</sub> .....	44.68	46.18	41.40	41.8	42.99	46.32	37.29
P <sub>2</sub> O <sub>5</sub> .....	.07	.06	Trace	-----	-----	-----	-----
SO <sub>3</sub> .....	.05	-----	-----	-----	-----	-----	-----
Cl.....	.02	.09	-----	-----	-----	-----	-----
MnO.....	.01	.28	-----	.4	.29	.21	-----
SrO.....	.22	None	-----	-----	-----	-----	-----
Na <sub>2</sub> O.....	-----	.08	-----	-----	-----	-----	-----
BaO.....	-----	None	-----	-----	-----	-----	-----
	100.35	100.08	99.69	99.9	99.07	99.70	-----
Less O = Cl.....	-----	.02	-----	-----	-----	-----	-----
	-----	100.06	-----	-----	-----	-----	-----





## CUBA

Matrix from coral reef, Guantanamo Harbor, collected by T. W. Vaughan. Partial analysis by George Steiger, record 3213.

(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	0.16
CaO.....	47.12
MgO.....	1.11
CO <sub>2</sub> (calculated).....	38.24
	96.63

## DISTRICT OF COLUMBIA

White calcareous deposit near Tenleytown, collected by N. H. Darton. Analysis by George Steiger, record D-303. Insoluble in 1-4 HCl boiling 3 minutes, 12.14 percent.

Insoluble.....	12.14	Soluble—Continued.		Soluble—Continued.	
Soluble:		CaO.....	36.75	CO <sub>2</sub> .....	8.86
SiO <sub>2</sub> .....	13.85	H <sub>2</sub> O.....	5.50	P <sub>2</sub> O <sub>5</sub> .....	.14
Al <sub>2</sub> O <sub>3</sub> .....	4.43	H <sub>2</sub> O+.....	13.68		
Fe <sub>2</sub> O <sub>3</sub> .....	2.39	TiO <sub>2</sub> .....	.19		100.10
MgO.....	2.17				

<sup>1</sup> Of this soluble silica 12.35 percent went perfectly into solution with HCl; the remaining 1.50 percent was deposited as sandy silica and remained with the residue; it was dissolved by boiling for 15 minutes with a 5 percent solution of Na<sub>2</sub>CO<sub>3</sub> and evidently belonged to a silicate mineral decomposed by boiling HCl.

## GEORGIA

Two samples of marble from Tate, collected by T. N. Dale. Analyses by Chase Palmer, record 3195.

A. Coarse calcite marble with graphitic cloud. Microscope shows very little quartz, graphite, and pyrrhotite.

B. High power shows very minute pink dots. Contains also hornblende, quartz, and titanite.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	0.14	0.05	MgO.....	0.25	0.22	S.....	Trace	Trace
Al <sub>2</sub> O <sub>3</sub> .....	.31	.07	MnO.....		None	C.....	Trace	Trace
FeO.....	.05	.04	(K,Na) <sub>2</sub> O.....	.15	.31			
CaO.....	55.29	55.71	CO <sub>2</sub> .....	43.45	43.53		99.64	99.93

## HAITI

Four samples of limestone collected by J. S. Brown. Analyses by J. G. Fairchild, record C-293.

A. Top of divide, road Port au Prince to Cape Haitien.

B. Beach near Mont-Rouis.

C. Miocene marl from valley 2 or 3 kilometers north of St. Marc.

D. Clay from Plaisance Valley.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	0.14	0.50	25.42	51.30	CO <sub>2</sub> .....	43.45	43.18	23.75	5.09
Al <sub>2</sub> O <sub>3</sub> .....	.26	.20	8.32	16.88	H <sub>2</sub> O.....			6.38	8.32
Fe <sub>2</sub> O <sub>3</sub> .....			1.93	4.77					
CaO.....	55.60	55.12	30.33	8.06		99.90	99.56	98.40	97.58
MgO.....	.45	.56	2.27	3.16					

## IDAHO

Samples collected by C. P. Ross.

A-B. Travertine from Bayhorse quadrangle, southwest of Challis, Custer County. Analysis by J. G. Fairchild, record D-93.

C. Carbonate from open cut, Yellow Jacket mine, Casto quadrangle. Analysis by J. J. Fahey, record D-259. Description in United States Geological Survey Bulletin 854, 1935.

D. Average limestone, Casto quadrangle.

E. Contact-metamorphic limestone, Casto quadrangle. Analyses D-E by J. G. Fairchild, record C-927.



	A	B	C	D	E		A	B	C	D	E
CaO.....	52.90	51.78	53.40	33.44	15.32	Soluble SiO <sub>2</sub> .....	0.05	-----	-----	-----	-----
MgO.....	1.43	1.63	.79	10.59	8.54	Insoluble.....	2.18	2.47	0.99	13.84	46.70
CO <sub>2</sub> .....	43.31	43.24	43.35	37.82	(1)	TiO <sub>2</sub> .....	-----	-----	-----	.10	-----
Al <sub>2</sub> O <sub>3</sub> .....	None	None	-----	1.50	8.11						
Fe <sub>2</sub> O <sub>3</sub> .....	None	None	-----	1.72	12.97						
SO <sub>3</sub> .....	.12	-----	-----	-----	-----		99.99	99.12	99.47	99.01	91.90

<sup>1</sup> Undetermined.

INDIANA

Limestone, Bedford. Special analysis of part insoluble in cold 1-5 hydrochloric acid, by George Steiger, record C-1076.

SiO <sub>2</sub> .....	83.89	Na <sub>2</sub> O.....	0.41
Al <sub>2</sub> O <sub>3</sub> .....	5.84	K <sub>2</sub> O.....	1.73
Fe <sub>2</sub> O <sub>3</sub> .....	6.83	TiO <sub>2</sub> .....	.30
MgO.....	.64		
CaO.....	1.06		
			100.70

IOWA

Dolomitic limestone near Burlington, of Kinderhook (Mississippian) age, collected by J. S. Williams. Analysis by E. T. Erickson, record D-204.

Insoluble.....	3.16
R <sub>2</sub> O <sub>3</sub> .....	1.08
CaCO <sub>3</sub> .....	67.71
MgCO <sub>3</sub> .....	28.26
	100.21

KANSAS

Five samples of limestone, Syracuse quadrangle. Analyses by W. C. Wheeler, record 2878.

- A. Eighteen miles southwest of Syracuse.
- B. Northwest of Kendall.
- C. Southeast of Syracuse.
- D. Well southwest of Syracuse.
- E. Quarry at Syracuse.

	A	B	C	D	E		A	B	C	D	E
Insoluble.....	1.79	3.61	18.56	2.72	3.18	Ignition.....	43.39	42.04	35.18	42.32	42.35
CaO.....	52.99	52.58	42.75	52.26	52.26						
MgO.....	.40	.32	.39	.49	.47		98.57	98.55	96.88	97.79	98.26

KENTUCKY

- A. Limestone from locality about 50 miles south of Louisville, submitted by W. E. Boykin. Analysis by Charles Milton, record D-171.
- B. Oil sand (composite sample), Irving oil field. Partial analysis by George Steiger, record 3135.

	A	B		A	B	
CaO.....	55.60	22.3	Al <sub>2</sub> O <sub>3</sub> ..... Fe <sub>2</sub> O <sub>3</sub> ..... Insoluble.....	} 0.11	-----	
MgO.....	.30	14.3				-----
CO <sub>2</sub> .....	43.61	34.3				.80
H <sub>2</sub> O.....	None	-----				
H <sub>2</sub> O+.....	.13	-----				
					100.55	98.0

MARYLAND

Dolomite from Beaver Dam quarries, Cockeyville, U. S. Nat. Museum 76037. Analysis by R. C. Wells, record 3029.

CaO.....	30.88	(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	0.22
MgO.....	21.28	CO <sub>2</sub> (calculated).....	47.59
FeO.....	.17		
SiO <sub>2</sub> .....	.23		
			100.37



## MASSACHUSETTS

Eleven samples of dolomite collected and described by T. N. Dale in Bull. 744, 1923. Analyses by J. G. Fairchild, record 3238.

- A. Briggs quarry, Sheffield.  
 B. Charles Reed place, Great Barrington.  
 C. Miller quarry, West Stockbridge.  
 D. Two miles southwest of West Stockbridge.  
 E. Knoll 0.5 mile southeast of marble quarry, West Stockbridge.  
 F. Truesdell quarry, north end of West Stockbridge village.  
 G. Southwest foot of Rattlesnake Hill, Stockbridge.  
 H. Hutchinson quarry, Lenox.  
 I. East of New England Lime Co.'s Renfrew quarry, Adams.  
 J. Near Upton's, northwest of Adams.  
 K. Hilltop near Dean's mill, west of Adams.

	A	B	C	D	E	F	G	H	I	J	K
SiO <sub>2</sub> .....	2.40	1.78	1.83	1.30	11.03	16.22	1.58	5.02	0.68	10.78	13.63
Al <sub>2</sub> O <sub>3</sub> .....	1.38		.60		2.23	.15	.48	1.49	.07	.06	.10
Fe <sub>2</sub> O <sub>3</sub> .....		.12	Trace	Trace	Trace	.06	Trace	.48	.05	Trace	Trace
FeO.....	.73	.16	.31	.24	.21	.41	.18	.80	.20	.25	.28
MgO.....	17.50	20.17	12.99	18.75	18.18	17.34	20.99	18.20	20.75	20.46	20.33
CaO.....	31.86	31.45	39.53	32.96	27.08	32.28	30.52	30.02	31.30	32.07	30.42
Na <sub>2</sub> O.....			.08						.05		
K <sub>2</sub> O.....			.30		.64		.17	.69			
CO <sub>2</sub> .....	44.56	46.26	44.48	45.78	40.38	43.66	46.50	42.66	46.86	46.64	45.46
P <sub>2</sub> O <sub>5</sub> .....						.03	.06				
TiO <sub>2</sub> .....							.05				
	99.65	99.94	100.12	100.03	99.75	100.12	100.45	99.47	99.96	100.26	100.22

<sup>1</sup> Insoluble in acid, other constituents soluble in acid.

## MONTANA

A. Madison limestone (Mississippian) from north end of Big Horn Canyon, south of Hardin. Collected by K. C. Heald in studies of oil-bearing limestones. Analysis by E. T. Erickson, record C-304.

B. Limestone from Capitol Rock, T. 3 S., R. 62 E. Analysis by W. C. Wheeler, record 3006.

	A	B		A	B		A	B
SiO <sub>2</sub> and insoluble.....	0.43	28.90	H <sub>2</sub> O.....	0.02	-----	SO <sub>3</sub> .....	0.03	-----
Al <sub>2</sub> O <sub>3</sub> .....	.42	4.00	Organic matter and H <sub>2</sub> O+.....	.34	-----	S.....	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....			TiO <sub>2</sub> .....	.01	-----	Cl.....	.06	-----
FeO.....	.04		CO <sub>2</sub> .....	46.91	-----	MnO.....	Trace	-----
MgO.....	19.93	1.26	Ignition.....	-----	30.02	SrO.....	.09	-----
CaO.....	31.72	35.79	P <sub>2</sub> O <sub>5</sub> .....	Trace	-----		100.00	99.97

## NEVADA

Limestone and dolomite collected by D. F. Hewett in the Goodsprings quadrangle and described in Prof. Paper 162, 1931. Analyses by J. G. Fairchild; Aa-U, record C-547; V, record C-473.

Aa-Fa. Anchor limestone member of Monte Cristo limestone.

Ab-Fb. Dolomitized limestone about 6 feet from contact of corresponding samples Aa-Fa.

Ga-La. Bird Spring formation.

Gb-Lb. Same bed dolomitized.

M. Dolomitized limestone of Monte Cristo limestone.

N-U. Limestone, dolomite, and altered products.

V. Dolomite partly altered by Tertiary intrusives into brucite.



	Aa	Ab	Ba	Bb	Ca	Cb	Da
CaO.....	55.32	31.40	55.18	31.98	55.28	31.52	54.98
MgO.....	.25	21.11	Trace	20.22	Trace	21.00	.25
CO <sub>2</sub> .....	43.20	46.40	43.42	46.60	43.20	47.13	43.80
Fe <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	None	None	None
Al <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	None	None	None
	98.77	98.91	98.60	98.80	98.48	99.65	99.03

	Db	Ea	Eb	Fa	Fb	Ga	Gb
CaO.....	31.44	55.68	32.32	52.88	32.16	54.76	29.28
MgO.....	21.31	.10	20.58	2.84	20.66	Trace	19.77
CO <sub>2</sub> .....	47.07	43.82	47.40	44.20	47.45	42.82	43.70
Fe <sub>2</sub> O <sub>3</sub> .....	None	None	None	Trace	Trace	.10	Trace
Al <sub>2</sub> O <sub>3</sub> .....	None	None	None				
Insoluble.....						2.05	6.00
	99.82	99.60	100.30	99.92	100.27	99.73	98.75

	Ha	Hb	Ia	Ib	Ja	Jb	Ka
CaO.....	55.24	28.76	55.66	32.56	52.92	29.90	48.14
MgO.....	.22	20.12	Trace	19.68	Trace	20.46	.30
CO <sub>2</sub> .....	43.80	44.44	43.60	46.63	40.99	44.65	38.71
Fe <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	None	None	None
Al <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	None	None	None
Insoluble.....		7.32			5.91	5.42	12.14
	99.26	100.64	99.26	98.87	99.82	100.43	99.29

	Kb	La	Lb	M	N	Oa	Ob	P	Q	R	S	T
CaO.....	29.24	55.20	32.72	30.70	36.88	31.00	31.28	55.40	31.24	36.20	52.72	53.62
MgO.....	17.47	Trace	18.73	21.63	13.48	21.55	20.58	.25	18.49	22.28	.88	.20
CO <sub>2</sub> .....	41.90	42.80	45.27	47.13	43.57	47.13	45.80	43.72	43.95	34.77	42.46	42.10
Fe <sub>2</sub> O <sub>3</sub> .....	.10	None	None	Trace	.20	Trace	Trace	None	None	Trace	Trace	.48
Al <sub>2</sub> O <sub>3</sub> .....												
Insoluble.....	10.85				5.80	.20	1.40		6.03			(?)
Organic matter + water.....										6.59		
	99.56	98.00	96.72	99.46	99.93	99.88	99.44	99.37	99.71	99.84	96.06	97.59

	U	V		U	V
CaO.....	49.02	31.80	H <sub>2</sub> O.....		<sup>3</sup> 1.99
MgO.....	.15	22.22	Insoluble.....	3.08	<sup>6</sup> 0.10
CO <sub>2</sub> .....	38.50	43.48	Organic matter + water.....	1.06	
Fe <sub>2</sub> O <sub>3</sub> .....	1.57				
Al <sub>2</sub> O <sub>3</sub> .....	.21			<sup>4</sup> 98.59	99.76
H <sub>2</sub> O.....		.17			

<sup>1</sup> Trace of sulphide present. 0.3 percent SO<sub>3</sub> in Ga. Samples contain a small quantity of organic matter.  
<sup>2</sup> Not determined.  
<sup>3</sup> Organic matter is not more than a trace.  
<sup>4</sup> 1.19 MnO is insoluble in T, 1.35 MnO in U, available O not determined.  
<sup>5</sup> Loss on ignition less CO<sub>2</sub> and H<sub>2</sub>O-.  
<sup>6</sup> Approximate.

W-Z. Four specimens of a magnesite series from southern Nevada overlying Overton conglomerate 4 miles west of Overton, Clark County. Analyses by J. G. Fairchild, record C-443.

- W. Lower series.
- X. 20 feet higher.
- Y. Lower bed of lower.
- Z. Middle bed of lower.



	W	X	Y	Z		W	X	Y	Z
Soluble in 1-3 HCl:					Insoluble:				
SiO <sub>2</sub> -----	0.99	0.92	0.63	0.32	SiO <sub>2</sub> -----	15.78	24.82	11.63	7.66
Al <sub>2</sub> O <sub>3</sub> -----	Trace	Trace	( <sup>1</sup> )	( <sup>1</sup> )	Al <sub>2</sub> O <sub>3</sub> -----	2.07	4.43	1.31	4.83
Fe <sub>2</sub> O <sub>3</sub> -----	.41	.50	1.63	2.47	Fe <sub>2</sub> O <sub>3</sub> -----	.77	.53	( <sup>1</sup> )	( <sup>1</sup> )
FeO-----	1.03	.73	( <sup>1</sup> )	( <sup>1</sup> )	MgO-----	.30	.52	.09	.12
CaO-----	24.37	20.17	22.52	6.30	CaO-----	None	Trace	Trace	Trace
MgO-----	15.27	12.35	21.60	37.25	K <sub>2</sub> O <sup>5</sup> -----	2.01	3.44	<.49	.36
CO <sub>2</sub> -----	34.40	28.10	34.74	41.36	Na <sub>2</sub> O-----	.22	.53		
P <sub>2</sub> O <sub>5</sub> -----	3.05	2.10	Trace	None	H <sub>2</sub> O (ignition) <sup>6</sup> -----	1.96	2.38	5.10	4.38
						99.63	99.52	99.74	99.05

<sup>1</sup> Undetermined.

<sup>2</sup> Includes a little Al<sub>2</sub>O<sub>3</sub> and total iron.

<sup>3</sup> Approximate.

<sup>4</sup> Includes a little Fe<sub>2</sub>O<sub>3</sub>.

<sup>5</sup> Includes any soluble alkali.

<sup>6</sup> The unusual quantity of water in Y and Z comes chiefly from the soluble portion and points to the presence of a hydrated compound of magnesium.

AA, BB. Rocks from Magnesite Wash, 5 miles southwest of Overton, collected by W. W. Rubey.

AA. Magnesitic rock. Analysis by J. G. Fairchild, record D-304.

BB. Associated claylike material. Analysis by E. T. Erickson, record D-307.

CC. Dolomite from Shafter, collected by D. F. Hewett. Analysis by J. G. Fairchild, record C-1038.

	AA	BB	CC		AA	BB	CC
Insoluble in HCl-----	8.22	42.26	6.58	Soluble-Continued.			
Soluble:				FeO-----			None
CaO-----	16.55	2.38	28.99	MnO-----			1.27
MgO-----	29.15	21.76	18.32				
CO <sub>2</sub> -----	42.35	3.61	43.60	MnO <sub>2</sub> in insoluble-----			98.76
Loss on ignition-----	44.47	13.70	-----				.72
H <sub>2</sub> O-----	1.01	13.24	-----				

DD-GG. Samples collected by Eugene Callaghan. Analyses DD, EE, by Charles Milton, record D-292, FF, GG, by E. T. Erickson, record D-157.

DD. Magnesitic rock from Callville Wash.

EE. Magnesite from Horse Spring formation, Overton.

FF. Magnesite from hillside east of upper brucite deposit, Paradise Range, Mineral County.

GG. Dolomite 75 feet east of FF.

HH. Dolomitic magnesite from Currant district, southwest of Ely. Submitted by Eugene Callaghan and W. W. Rubey. Analysis by Charles Milton, record D-426.

	DD	EE	FF	GG	HH		DD	EE	FF	GG	HH
SiO <sub>2</sub> -----	12.19	11.65	0.43	0.44	15.61	CO <sub>2</sub> -----	32.47	40.09	51.03	47.05	36.54
Al <sub>2</sub> O <sub>3</sub> -----	.38	1.18	.13	.15	} 2.51	P <sub>2</sub> O <sub>5</sub> -----			.03	.01	
Fe <sub>2</sub> O <sub>3</sub> -----	.09	.25	.23	.14		SO <sub>3</sub> -----	3.26	.12			
FeO-----			.22	.09		S-----			.03	.01	
MgO-----	20.30	37.66	45.35	21.56	29.53	MnO-----			.02	.02	
CaO-----	24.15	4.87	2.20	30.64	15.71	Li <sub>2</sub> O-----	.17	.22			
Na <sub>2</sub> O-----	.28	.31				B <sub>2</sub> O <sub>3</sub> -----	.18	None			
K <sub>2</sub> O-----	.29	.32				C-----			Trace	Trace	
H <sub>2</sub> O-----	3.55	2.15	None	None							
H <sub>2</sub> O+-----	2.24	1.82	.11	.12							
TiO <sub>2</sub> -----	.01	.01	Trace	Trace			99.56	100.65	99.78	100.23	100.10

<sup>1</sup> Ignition.

II, JJ. Two limestones from the Yerington district, collected and described by Adolph Knopf in Prof. Paper 114, 1918. Analyses by W. C. Wheeler, record 3052.

II. One inch from pyroxene-andradite-chalcopyrite ore body of the Mason Valley mine.

JJ. South end of ore zone.



KK. Limestone from Ely, collected by D. F. Hewett.

LL. Altered limestone KK. Analyses KK, LL by J. G. Fairchild, record C-1038.

	II	JJ	KK	LL		II	JJ	KK	LL
SiO <sub>2</sub> -----	1.80	3.04	9.24	8.96	CO <sub>2</sub> (calculated)----	43.98	41.82	40.57	43.24
Al <sub>2</sub> O <sub>3</sub> -----	.14	1.39			MnO-----			.17	.63
Fe <sub>2</sub> O <sub>3</sub> (total Fe)----	.17	.64							
FeO-----			None	None		100.89	99.85	99.85	99.83
MgO-----	3.17	.84	4.30	19.18					
CaO-----	51.63	52.12	45.57	27.82	MnO <sub>2</sub> in insoluble----				2.26

NEW MEXICO

A-E. Limestones from the red beds. Analysis of portion soluble in hydrochloric acid by Chase Palmer, record 3170.

A. Chupadera formation, northwest of Queen.

B. Fusselman limestone, San Andres Canyon.

C. Tertiary, 1 mile east of Helen.

D. Chupadera formation, 10 miles north of Prairie Springs.

E. Between gypsum beds 10 miles southeast of Hope.

	A	B	C	D	E
CaCO <sub>3</sub> -----	54.25	51.80	89.30	52.20	54.41
MgCO <sub>3</sub> -----	38.70	38.00	Trace	38.22	36.12

F-J. Dolomite from Government test hole 18, Carlsbad formation, collected by W. B. Lang. Analyses by L. T. Richardson, record D-22.

F, Surface (?); G, 177 feet; H, 1,136 feet; I, 1,160 feet; J, 1,180 feet.

K. Dolomitic Permian limestone from 20 miles west of Carlsbad, collected by W. B. Lang. Partial analysis by L. T. Richardson, record D-42.

	F	G	H	I	J	K
CaO-----	30.87	27.32	30.24	27.33	28.34	30.05
MgO-----	20.18	20.30	19.19	20.03	20.52	20.47
Loss on ignition-----	46.65	43.03	45.57	42.75	44.07	-----
R <sub>2</sub> O <sub>3</sub> -----	.46	1.01	.29	1.14	.75	-----
Insoluble in 1-5 HCl-----	1.70	7.58	.58	7.94	5.26	-----
SO <sub>3</sub> -----	.05	.21	3.20	.44	.23	2.35
NaCl-----	.08	.49	1.02	.41	.71	-----
	99.99	99.94	100.09	100.04	99.88	-----

L. Black caliche, common on the High Plains, from Roosevelt County, T. 6 S., R. 38 E., collected by W. B. Lang. Analysis by E. P. Henderson, record C-1028 Insoluble quartz grains and clay. Color caused by organic matter soluble in chloroform.

Insoluble-----	9.56
CaCO <sub>3</sub> -----	88.63
CaSO <sub>4</sub> ·2H <sub>2</sub> O-----	.88
R <sub>2</sub> O <sub>3</sub> -----	.70
	99.77

NEW YORK

A. Marl, Montezuma Marsh. Partial analysis by Chase Palmer, record 3235.

B. Dolomite from Oregon, Putnam County. Partial analysis by A. A. Chambers, record 3103.

	A	B		A	B
MgO-----	1.21	20.41	P <sub>2</sub> O <sub>5</sub> -----	None	-----
CaO-----	45.75	29.82			
CO <sub>2</sub> -----	35.32	45.78		82.28	96.01



## OHIO

Four samples of limestone from the Woodsfield and Summerfield quadrangles, collected by D. D. Condit. Analyses by A. A. Chambers, record 3075.

- A. Calcareous clay, Alledonia station, Belmont County.  
 B. Lower Pittsburgh limestone, Bailey's Mills, Belmont County.  
 C. Same, Chaseville, Noble County.  
 D. Ames limestone, Senecaville, Guernsey County.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	25.70	2.83	1.48	12.72	CaO.....	17.81	52.78	53.38	44.32
Al <sub>2</sub> O <sub>3</sub> +Fe <sub>2</sub> O <sub>3</sub> .....	14.38	1.05	1.10	4.20	P <sub>2</sub> O <sub>5</sub> .....				.48
MgO.....	10.27	.42	.20	.10					

## OKLAHOMA

A-E. Five limestones from Foraker quadrangle, studied by K. C. Heald. Analyses by Chase Palmer, record 3102. No MgO, S, or SO<sub>3</sub>.

	A	B	C	D	E
Insoluble.....	1.92	4.62	3.51	8.83	10.28
CaO.....	54.04	52.88	54.08	48.94	45.81
CO <sub>2</sub> .....	41.25	40.44	41.54	36.41	34.74
Fe <sub>2</sub> O <sub>3</sub> (total Fe).....	.46	.99	.33	2.31	5.72
	97.68	98.93	99.46	96.49	96.55

F, G. Two dolomites near Paden, collected by A. E. Fath. Analyses by W. C. Wheeler, record 3023. F, Gray; G, red.

H-K. Four samples of limestone collected by D. F. Hewett. Determinations of acid-soluble matter by J. G. Fairchild, record 3276.

H. From a deposit on Moseley Creek near Bromide, Johnson County, SW $\frac{1}{4}$  sec. 28, T. 1 S., R. 8 E., in a vein with manganese minerals.

I. Hunton limestone 2 feet from vein.

J. Same 15 feet from vein.

K. Viola limestone several feet from a similar vein, SW $\frac{1}{4}$  sec. 13, T. 2 S., R. 7 E

	F	G	H	I	J	K
Insoluble in HCl (sand).....	12.22	12.17				
Al <sub>2</sub> O <sub>3</sub> .....	.94	.07				
Fe <sub>2</sub> O <sub>3</sub> .....	1.00	4.08				
FeO.....	3.60	.75	4.02	3.45	0.28	4.02
MgO.....	14.98	17.76	14.35	12.15	.30	6.02
CaO.....	26.67	25.15	29.02	29.02	40.56	41.82
MnO.....	.57	.80	6.42	9.08	.39	.60
Ignition.....	40.18	40.06	44.89	43.79	32.30	42.25
	100.16	100.84	98.70	97.49	73.83	94.71

## OREGON

A-J. Samples of limestone collected by R. W. Richards and B. N. Moore. Analyses by J. G. Fairchild, record D-63.

- A. Sec. 3, T. 12 S., R. 44 E., Sisley Creek, Baker County.  
 B. Sec. 4, T. 12 S., R. 43 E., Nelson, Baker County.  
 C. Sec. 2, T. 2 S., R. 44 E., Black Line quarry, Wallowa County.  
 D. Sec. 15, T. 23 S., R. 48 E., Imnaha River, Wallowa County.  
 E. Sec. 10, T. 4 S., R. 44 E., Hurricane Creek, Wallowa County.  
 F. Sec. 5, T. 2 S., R. 43 E., Lostine Creek, Wallowa County.  
 G. Sec. 21, T. 7 S., R. 44 E., Martins Bridge, Baker County.  
 H. Sec. 28, T. 11 S., R. 45 E., Comas Creek, Baker County.  
 I. Sec. 7, T. 18 S., R. 25 E., Grindstone Creek, Crook County.  
 J. Sec. 18, T. 19 S., R. 42 E., Jackass Creek, Grant County.



	A	B	C	D	E	F	G	H	I	J
SiO <sub>2</sub> .....	11.21	44.85	1.17	1.12	0.12	0.92	10.92	Trace	9.40	2.08
Al <sub>2</sub> O <sub>3</sub> .....	.15	.77	.17	.20	Trace	.34	3.21	None	.62	.40
Fe <sub>2</sub> O <sub>3</sub> .....	.17	.60	.12	.10	Trace	Trace	1.63	Trace	.48	.34
FeO.....	None	None	None	None	None	Undet.	.52	None	None	Trace
MgO.....	.52	.79	1.23	.36	.28	.52	.85	.52	.64	.16
CaO.....	49.82	29.72	53.15	54.44	55.62	54.50	45.36	55.65	49.12	54.05
Na <sub>2</sub> O.....	.21	.10	.08	.19	.11	Trace	.22	Trace	.15	.17
K <sub>2</sub> O.....	Trace	.25	.08	Trace	Trace	Trace	.45	Trace	Trace	Trace
H <sub>2</sub> O.....	Trace	.10	.10	.20	.10	.10	.90	None	.60	.31
TiO <sub>2</sub> .....	Trace	Trace	Trace	Trace	None	Trace	.20	None	Trace	Trace
CO <sub>2</sub> .....	38.39	23.10	42.05	43.19	43.67	43.18	36.24	43.93	38.83	42.50
P <sub>2</sub> O <sub>5</sub> .....	.05	.10	Trace	.05	None	Trace	.07	None	Trace	Trace
SO <sub>3</sub> .....	Trace	None	None	None	None	Trace	Trace	Undet.	None	None
MnO.....	.02	.10	Trace	Trace	Trace	Trace	.03	Trace	Trace	.10
SrO <sup>1</sup> .....	None?	None?	.40	None?	None?	None?	None?	None?	None?	None?
Li <sub>2</sub> O.....	Trace	Trace	Trace	None	None	None	None	None	None	None
FeS <sub>2</sub> .....	Trace	None	None	None	None	.24	.14	None	None	None
Organic matter....	Trace	Trace	1.75	.07	None	Trace	.14	None	Trace	Trace
	100.45	100.39	100.30	99.92	99.90	99.80	100.67	100.10	99.84	100.11
Specific gravity....	2.70	2.68	2.61	2.68	2.71	2.72	2.61	2.73	2.68	2.73

<sup>1</sup> Mere traces not determined.

K, L. Two samples of limestone, Sumpter quadrangle, collected by J. T. Pardee. Analyses by W. C. Wheeler, record 3055. K, Marble Creek; L, Marble Point.

M. Dolomite from Wallowa Mountains, T. 6 S., R. 46 E., collected by C. P. Ross. Analysis by J. G. Fairchild, record C-332.

	K	L	M		K	L	M
SiO <sub>2</sub> .....	0.71	0.07	.....	CaO.....	53.76	55.76	32.84
Al <sub>2</sub> O <sub>3</sub> .....	.05	.03	.....	CO <sub>2</sub> .....	43.87	43.99	46.60
Fe <sub>2</sub> O <sub>3</sub> (total Fe).....	.12	.08	.....				
MgO.....	1.55	.22	20.52		100.06	100.15	99.96

PANAMA

Pleistocene deposit on Mount Hope, collected by T. W. Vaughan. Partial analysis by George Steiger, record 3213.

(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	0.27
CaO.....	21.48
MgO.....	.35
CO <sub>2</sub> (calculated).....	17.27

39.37

PENNSYLVANIA

A-G. Limestone from Somerset quadrangle. Analyses by W. C. Wheeler, record 2888.

- A. Laurel Hill, 6 miles northeast of Ligonier.
- B. Laurel Hill.
- C. Adams mine, 5 miles northeast of Somerset.
- D. 3 miles southeast of Ligonier.
- E. 1 1/4 miles southwest of Lavansville.
- F. 4 miles north of Boswell.
- G. 2 1/2 miles north of Boswell.
- H. Limestone near Greensburg. Analysis by R. C. Wells, record D-408.

	A	B	C	D	E	F	G	H
Insoluble.....	22.22	47.60	3.61	3.48	4.21	3.37	3.43	10.57
(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	12.32	2.58	2.03	2.44	2.72	2.05	2.46	2.54
CaO.....	33.35	27.08	50.95	51.30	49.72	51.76	45.60	40.67
MgO.....	1.12	.42	.97	.69	1.23	.69	5.30	6.42
MnO.....	.33	.....	.....	.....	.....	.....	.....	.....
Ignition.....	29.39	22.41	42.35	41.92	41.64	42.04	43.07	39.66
	98.73	100.09	99.91	99.83	99.52	99.91	99.86	99.86



## SOUTH DAKOTA

Carbonates from the gold-bearing schists of the Homestake mine at Lead, collected by Sidney Paige and described in Bull. 765, 1924. Analyses by J. G. Fairchild, record C-211.

A. From De Smet open cut. Quartz, green mica, siderite.

B. From 300-foot level of Old Abe shaft. Chlorite, mica, amphibole, quartz, and carbonates.

C. From 400-foot level, Caledonia ore body. Chlorite in a groundmass of carbonates and quartz.

D. From 600-foot level near Deadwood Terra shaft.

E. From Incline ore body. Cummingtonite, quartz, and siderite.

F. From 500-foot level near Deadwood Terra shaft. Quartz, carbonate, and carbonaceous matter.

	A	B	C <sup>1</sup>	D <sup>2</sup>	E	F
<i>Acid-soluble portion</i>						
CaO.....	None	3.1	0.4	12.7	None	11.7
MgO.....	2.6	4.6	1.2	7.7	2.5	4.8
FeO+Fe <sub>2</sub> O <sub>3</sub> .....	23.9	31.5	11.0	6.4	20.2	12.4
CO <sub>2</sub> .....	7.2	9.2	6.0	22.7	7.8	20.5
MnO.....				2.0		
<i>Carbonates</i>						
CaCO <sub>3</sub> .....	None	5.5	.7	22.7	None	20.9
MgCO <sub>3</sub> .....	5.4	9.6	2.5	16.1	5.2	10.0
FeCO <sub>3</sub> .....	11.6	4.7	11.6	9.3	13.4	16.1
MnCO <sub>3</sub> .....				2.1		
Fe <sub>2</sub> O <sub>3</sub> as limonite.....	16.0	28.3	3.1	None	11.0	1.3

<sup>1</sup> Contains FeS<sub>2</sub>.

<sup>2</sup> Contains MnCO<sub>3</sub>, some FeS<sub>2</sub>.

## TENNESSEE

A-C. Samples of marble. A, McMullen quarry, Knoxville; B, Friendsville; C, Luttrell. Analyses by R. C. Wells, record 3013.

D, E. Marble from near Knoxville, fine and coarse material, divided by a suture, submitted by A. C. Lawson. Tests by R. C. Wells, record C-504, to detect any possible chemical differences for the textures. D, Fine-grained; E, coarse-grained. The fine-grained part also showed more organic matter.

	A	B	C	D	E		A	B	C	D	E
Ignition.....	43.80	43.66	43.38			SiO <sub>2</sub> .....	0.05	0.16	0.47	0.40	0.07
CaO.....	55.70	55.37	55.37			S.....	.03	.01	.01		
MgO.....	.02	.13	.23	0.26	0.25						
MnO.....	.01	.02	.01				99.81	99.71	100.41		
Fe <sub>2</sub> O <sub>3</sub> .....	.17	.21	.46	.25	.23						
Al <sub>2</sub> O <sub>3</sub> .....	.03	.15	.48								

## TEXAS

A. Limestone from a deep well near Mexia, collected by O. B. Hopkins. Analysis by R. M. Kamm, record 3151.

B. Limestone near Palestine, Anderson County, Austin chalk, collected by E. B. Eckel.

C. Georgetown limestone, same locality, collected by E. B. Eckel. Analyses B, C by J. G. Fairchild, record D-352.

	A	B	C		A	B	C
Insoluble.....	6.94			H <sub>2</sub> O.....	0.60	1.26	0.30
SiO <sub>2</sub> .....		5.55	1.16	TiO <sub>2</sub> .....		.07	.02
Al <sub>2</sub> O <sub>3</sub> .....		1.18	.45	CO <sub>2</sub> .....	37.98	39.52	42.60
Fe <sub>2</sub> O <sub>3</sub> .....	1.92	.89	.66	P <sub>2</sub> O <sub>5</sub> .....		.08	.01
FeO.....					None	None	
MgO.....	.09	.02	.02	S.....		.02	.05
CaO.....	50.24	50.74	53.96	MnO.....			
Na <sub>2</sub> O.....		.29	.27	Carbonaceous residue.....	1.34		
K <sub>2</sub> O.....							99.11



## UTAH

Six specimens from Ophir district showing the alteration of a limestone to a lead-zinc ore, collected by James Gilluly and described in Prof. Paper 173, 1932. Analyses by J. G. Fairchild, record C-1031.

- A. Unaltered limestone.  
 B. Slightly altered limestone containing some quartz and muscovite.  
 C. Same with orthoclase and chlorite.  
 D. Same with additional epidote.  
 E. Ore in hornfels.  
 F. Dolomite replacing limestone, Ophir Hill Consolidated mine.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	1.05	22.67	32.73	37.08	19.22	3.97
Al <sub>2</sub> O <sub>3</sub> .....	1.20	4.96	11.65	11.14	7.60	1.56
Fe <sub>2</sub> O <sub>3</sub> .....	.38	.97	1.19	1.35	.96	None
FeO.....	1.96	2.73	2.73	1.42	1.80	2.12
MgO.....	4.31	2.17	4.16	1.92	2.26	16.28
CaO.....	48.18	35.55	24.57	21.80	2.47	30.16
Na <sub>2</sub> O.....	Trace	Trace	Trace	.15	.59	.10
K <sub>2</sub> O.....	.12	1.59	3.92	7.00	3.68	.33
H <sub>2</sub> O.....	.05	None	.14	.06	None	.02
H <sub>2</sub> O+.....	.05	1.42	.70	.80	1.62	.16
TiO <sub>2</sub> .....	None	.25	.50	.50	.20	None
CO <sub>2</sub> .....	41.66	27.30	17.12	14.75	1.99	42.48
P <sub>2</sub> O <sub>5</sub> .....	.03	.26	.12	.25	.35	.03
Cl.....	.03	.02	.11	.03	Trace	Trace
F.....	None	None	None	None	.25	.75
S.....	.05	.56	.33	.17	.80	.03
MnO.....	.25	.10	.10	.20	.35	.95
FeS <sub>2</sub> .....	.37	Trace?	None	1.50	26.39	1.57
PbS.....	None	None	None	None	14.37	None
ZnS.....	None	None	None	None	15.07	None
ZnO.....	None	None	None	None	None	None
Cu.....	None	None	None	None	.40	None
Ag.....	None	None	None	None	Trace?	Trace?
Less O=S or F <sub>2</sub> .....	99.69	100.55	100.01	100.12	100.51	100.37
		.28	.17	.08	.32	.51
		100.27	99.84	100.04	100.19	99.86
Specific gravity:						
Particles.....	2,760	2,782	2,762	2,724	3,841	2,854
Lump.....	2,760	2,758	2,758	2,716	3,591	2,710

## VIRGINIA

Six samples of limestone collected by J. B. Eby. Analyses by J. G. Fairchild, record C-206.

A. Weathered fragments of Ordovician limestone near top of exposure on north side of Wallen Ridge, 2 miles west of Wise-Lee county line.

B. Fragments of Ordovician limestone in place, near middle of exposure on north side of Wallen Ridge, 2 miles west of Wise-Lee county line.

C, D. Fragments from Helderberg limestone in place from exposure on old road one-eighth mile east of Big Stone Gap high school.

E. Crushed limestone screenings from stone crusher, Simpson & Crawford quarry.

F. Fragments taken from quarry cars hauling stone to crusher, same quarry as E.

	A	B	C	D	E	F
Insoluble.....	6.94	5.02	2.80	2.02	6.04	9.04
(Fe,Al) <sub>2</sub> O <sub>3</sub> .....	.80	.46	.54	.08	.64	1.34
CaO.....	50.74	51.64	41.34	49.34	50.00	46.00
MgO.....	.49	1.24	10.79	4.61	2.19	3.39
CO <sub>2</sub> .....	40.42	41.93	44.25	43.78	41.69	39.85
	99.39	100.29	99.72	99.81	100.56	99.62



G. Dolomitic limestone associated with gypsum at North Holston mine, Smyth County. Analysis by J. G. Fairchild, record C-929.  $\text{CaCO}_3$ , 55.7;  $\text{MgCO}_3$ , 44.3.

H. Black limestone from quarry of Rockingham Marble Corporation, Harrisonburg, submitted by G. F. Loughlin. Analysis by Charles Milton, record D-247.

Soluble in dilute HCl:		
CaO.....	43.20	
MgO.....	6.05	
$\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$ .....	.34	
$\text{SiO}_2$ .....	.09	49.68
Insoluble in dilute HCl:		
$\text{FeS}_2 (= 0.61\text{Fe}_2\text{O}_3)$ .....	0.92	
$\text{SiO}_2$ .....	6.78	
$\text{Al}_2\text{O}_3$ , etc.....	1.92	9.62
Ignition loss.....		(40.89)
$\text{CO}_2$ (calculated).....	40.50	
$\text{H}_2\text{O}$ (calculated).....	.08	
Pyrite correction (-).....	.31	40.58
		99.88

## WASHINGTON

Nine samples of magnesite collected by R. W. Stone. Analyses by Chase Palmer, A-G, record 3220; H, I, record 3228.

A. 12 miles west of Valley.

B, C. 18 miles west of Springdale.

D, E. Allen quarry, Valley.

F, G. Chewelah.

H. Valley.

I. Chewelah.

	A	B	C	D	E	F	G	H	I
$\text{SiO}_2$ .....	4.27	4.83	5.60	0.46	1.20	0.64	5.56	5.33	1.85
FeO.....	.78	.85	.88	1.01	2.36	.85	1.74	1.15	1.00
CaO.....	1.07	7.39	6.88	.31	.92	.81	2.31	.35	1.74
MgO.....	45.02	38.41	40.90	46.23	90.59	47.27	74.39	43.52	45.20
$\text{CO}_2$ .....	49.51	47.81	46.03	50.32	5.23	50.31	15.95	47.91	49.70
Insoluble.....								1.81	
	100.65	99.29	100.29	98.33	100.30	99.88	99.95	100.07	99.49

<sup>1</sup>  $\text{Fe}_2\text{O}_3$ .

## WEST VIRGINIA

Travertine collected by Marshall Howe from Furnace Creek, 2 miles above Harpers Ferry. Partial analysis by E. T. Erickson, record D-49. Described in Prof. Paper 170, pp. 61-62, 1932. FeO, 0.17; MnO, 0.03; MgO, 0.64.

## WYOMING

A. Minnekahta limestone (Permian?) from Nichols Canyon, half a mile north of Sundance, Crook County. Collected by K. C. Heald in studies of oil-bearing limestones. Analysis by E. T. Erickson, record C-304.

B. Dolomite at base of Spearfish formation, northern Black Hills, collected by W. W. Rubey. Analysis by J. G. Fairchild, record C-941.

	A	B		A	B		A	B	
$\text{SiO}_2$ .....	0.89	-----	Organic matter and $\text{H}_2\text{O} +$ .....	0.15	-----	Cl.....	0.03	-----	
$\text{Al}_2\text{O}_3$ .....	.58	-----		$\text{TiO}_2$ .....	.01	-----	MnO.....	Trace	-----
FeO.....	.02	-----		$\text{CO}_2$ .....	43.30	45.68	SrO.....	.07	-----
MgO.....	None	20.46		$\text{P}_2\text{O}_5$ .....	Trace	-----			
CaO.....	55.01	31.28		$\text{SO}_3$ .....	.08	.71			
$\text{H}_2\text{O}$ .....	.04	-----					100.18	98.13	



## ANALYSES OF SLATES AND SHALES

## ALABAMA

A. Shale from Chilton County. Determination of carbonaceous matter by R. M. Kamm, record 3150, gave C, not graphite, 13.8 percent.

B. Shale near Erin, studied by David White. Analysis by George Steiger, record 2978, showed loss on ignition 6.52 percent; carbon, insoluble, and non-volatile, 5.03 percent.

## CALIFORNIA

A-C. Three samples of shale collected by H. W. Hoots from the Modelo formation of the Santa Monica Mountains. Analyses by J. G. Fairchild, record C-1007.

A. White diatomaceous shale from road near Hollywood Country Club.

B. Opal shale, 1 foot above volcanic ash bed on Mulholland Drive and about 50 feet above base of upper shale member of lower Modelo.

C. Hard platy shale 1 foot above volcanic ash bed on Mulholland Drive.

D, E. Two samples of Miocene shale from Kettleman Hills, collected by W. M. Bramlette. Analyses by R. C. Wells, record D-122.

D. Composite sample of ten siliceous shales.

E. Composite sample of ten diatomites or diatomaceous shales.

F. Altered shale from hanging wall of Argonaut mine, Mother Lode district, collected by Adolph Knopf and described in Prof. Paper 157, 1929. Analysis by J. G. Fairchild, record C-699. Ankerite, quartz, sericite, pyrite, and carbonaceous matter.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	73.71	73.04	55.80	82.69	65.20	57.21
Al <sub>2</sub> O <sub>3</sub> .....	7.25	3.58	4.13	1.76	4.56	11.76
Fe <sub>2</sub> O <sub>3</sub> .....	2.63	1.28	1.36	1.00	2.22	1.22
FeO.....	.44	.44	.44	.31?	.32?	4.30
MgO.....	1.47	.45	.50	1.08	1.54	3.58
CaO.....	1.72	8.63	18.14	2.93	6.47	3.43
Na <sub>2</sub> O.....	1.19	.40	.40	.50	1.64	2.84
K <sub>2</sub> O.....	1.00	.55	.75	2.61	3.22	2.47
H <sub>2</sub> O.....	2.88	2.82	2.58	4.75	9.31	.06
H <sub>2</sub> O+	6.94	2.69	3.02			
TiO <sub>2</sub> .....	.50	.30	.25	2.28	4.05	8.37
CO <sub>2</sub> .....	Trace?	5.96	12.81			
P <sub>2</sub> O <sub>5</sub> .....	.24	.15	.24	.21	.15	.....
SO <sub>3</sub> .....	.16	.05	Trace?	.....	.....	.....
Cl.....	.....	.....	.....	.15	1.22	.....
F.....	.....	.....	.....	.....	.....	.....
MnO.....	.....	.....	.....	.012	.009	.....
FeS <sub>2</sub> .....	.....	.....	.....	.....	.....	2.14
Organic matter.....	None	.10	.16	Small	Small	1.50
	100.13	100.44	100.58	100.282	99.909	100.41
Soluble SiO <sub>2</sub> (5 percent Na <sub>2</sub> CO <sub>3</sub> ).....	4.46	17.22	18.52	8.58	5.53	.....

<sup>1</sup> Includes P<sub>2</sub>O<sub>5</sub> if present.

## COLORADO

A, B. Two specimens of oil shale collected by W. H. Bradley. Determinations of "soluble silica" only by E. T. Erickson, record C-960, gave 0.25 percent in A and 0.14 percent in B.

A. Monarch Shale Oil mine, sec. 32, T. 6 S., R. 97 W., Garfield County. Carbonates, analcite, and accessory pyrite, feldspars, quartz, zircon, and apatite.

B. East Middle Fork of Parachute Creek, sec. 10, T. 5 S., R. 95 W. Chiefly iron-bearing beidellite, with similar accessories.

C, D. Two shales from Grand Junction studied by M. I. Goldman with references to the origin of the niter. Analyses of water-soluble portion by W. B. Hicks, record 3081.

	C	D		C	D		C	D
K.....	2.92	0.83	CO <sub>3</sub> .....	20.22	1.12	NO <sub>2</sub> .....	0.01	0.005
Na.....	34.10	16.84	SiO <sub>2</sub> .....	1.46	.53			
Ca.....	None	5.60	NH <sub>4</sub> .....	.17	.08			
Mg.....	None	5.54	NO <sub>3</sub> .....	.22	.37	Total soluble salts.....	0.36	2.09
SO <sub>4</sub> .....	40.90	69.09						



## IDAHO

A, B. Two samples of calcareous shale, Hailey quadrangle. Analyses by W. C. Wheeler, record 2882.

	A	B
Insoluble.....	69.85	74.32
CaO.....	9.24	11.33
MgO.....	5.66	1.85
Ignition.....	14.78	11.68

## OHIO

Shale collected by R. E. Lamborn. Analyses by J. G. Fairchild, record D-24.

A. From plant of Webster Brick Co., South Webster, Scioto County.

B. From plant of Marietta Shale Brick Co., Marietta.

C. From plant of Wadsworth Brick & Tile Co., 1½ miles southwest of Wadsworth, Medina County.

	A	B	C		A	B	C
Loss at 105° C.....	0.76	1.73	0.62	P <sub>2</sub> O <sub>5</sub> .....	0.31	0.19	0.15
Ignition loss.....	7.04	6.48	3.80	Na <sub>2</sub> O.....	.78	.93	.51
SiO <sub>2</sub> .....	56.64	55.80	75.24	K <sub>2</sub> O.....	3.92	3.33	2.63
Al <sub>2</sub> O <sub>3</sub> .....	18.33	18.65	10.96	MnO.....	Trace	Trace	Trace
Fe <sub>2</sub> O <sub>3</sub> <sup>1</sup> .....	8.70	8.16	4.01				
CaO.....	.66	2.08	.40		100.53	100.75	99.83
MgO.....	2.09	1.95	.61				
TiO <sub>2</sub> .....	1.30	1.45	.90	Inorganic carbon.....	.31	.29	.06

<sup>1</sup> FeO disregarded.

## SWEDEN

Kolm, a low-grade oil shale of Upper Cambrian age. Electroscopic determination by R. C. Wells, record C-930, gave 0.28 percent of UO<sub>3</sub>.

A. Partial analysis by R. C. Wells, described in Washington Acad. Sci. Jour., vol. 21, p. 409, 1931. Calculated age, 450 million years. B. Analysis of ash by M. F. Connor, record C-1008.

A	B
Pb.....	0.0264
U.....	.432
TiO <sub>2</sub> .....	.10
V <sub>2</sub> O <sub>5</sub> .....	.003
Be, Zr, Th.....	None
ZnO.....	.004
Mo.....	.013
Rare earths.....	Present
Ash.....	31.25
	SiO <sub>2</sub> ..... 48.68
	Al <sub>2</sub> O <sub>3</sub> ..... 20.34
	Fe <sub>2</sub> O <sub>3</sub> ..... 20.00
	CaO..... .90
	MgO..... 1.40
	SO <sub>2</sub> ..... .62
	Na <sub>2</sub> O..... .60
	K <sub>2</sub> O..... 5.84
	TiO <sub>2</sub> ..... .20
	P <sub>2</sub> O <sub>5</sub> ..... .15
	U <sub>2</sub> O <sub>3</sub> and undetermined..... 1.27
	100.00
	S on kolm..... 4.74
	Fe of pyrite..... 3.85

## WYOMING

Samples of shale and related products collected by W. W. Rubey.

A. Bentonite from mine near Pedro, lower part of the Pierre shale.

B. Carbonate concretions in the bentonite, upper part of Pierre shale.

C. Unaltered tuff from lower part of the shale at the mine.

D. Ironstone bedded in lower part of the shale, N½ sec. 17, T. 49 N., R. 66 W., Crook County.

E. Weathered Mowry shale near Thornton, described in Prof. Paper 154, pp. 153-170, 1929.

Analyses by J. G. Fairchild: A-C, record C-941; D and E, record C-870. D gives soluble in 1-1 hydrochloric acid.



	A	B	C	D	E
SiO <sub>2</sub> .....	56.93	.....	69.54	.....	84.14
Al <sub>2</sub> O <sub>3</sub> .....	14.75	.....	10.63	.....	5.79
Fe <sub>2</sub> O <sub>3</sub> .....	2.08	.....	.53	7.07	1.21
FeO.....	.....	.....	.....	11.25	.....
MgO.....	1.86	1.47	.22	.....	.41
CaO.....	6.35	22.06	3.27	26.04	.13
Na <sub>2</sub> O.....	2.28	.....	1.87	.....	.99
K <sub>2</sub> O.....	.93	.....	.80	.....	7.50
H <sub>2</sub> O.....	10.61	.....	12.76	.....	5.56
TiO <sub>2</sub> .....	.....	.....	.....	.....	.22
CO <sub>2</sub> .....	4.61	18.24	None	29.00	None
P <sub>2</sub> O <sub>5</sub> .....	.....	.....	.....	.....	.....
SO <sub>3</sub> .....	.....	.....	.....	.....	.....
Organic matter.....	.....	.....	.....	.....	1.21
Insoluble in HCl.....	.....	54.48	.....	.....	.....
	100.40	96.25	99.62	.....	100.41

ANALYSES OF CLAYS, SOILS, ETC.

The analyses of individualized, selected, and purified clays, where the material represents a single, homogeneous substance, are listed under minerals—for example, allophane, anauxite, beidellite, halloysite, kaolinite, leverrierite, montmorillonite, nontronite, potash clay, and saponite.

ALABAMA

A. Clay, residual from the Bangor limestone, collected by E. F. Burchard at the DeBardleben mine of the Alabama Fuel & Iron Co., Russellville district, Franklin County. Analysis by J. J. Fahey, record D-345.

B, C. Two samples of ferruginous sand from the Tuscaloosa formation, collected by E. F. Burchard in the Russellville district. B, Red Bay, C, Belgreen. Analyses by R. E. Stevens, record D-411.

D. Ferruginous surface soil, Langdon ore mines, Cherokee County, collected by E. F. Burchard. Analysis by R. E. Stevens, record D-458.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	46.96	82.64	83.46	51.85	Cr <sub>2</sub> O <sub>3</sub> .....	.....	.....	.....	0.04
Al <sub>2</sub> O <sub>3</sub> .....	14.52	8.61	8.16	16.57	C <sub>2</sub> O <sub>3</sub> .....	.....	0.02	0.02	.17
Fe <sub>2</sub> O <sub>3</sub> .....	6.92	3.83	3.97	18.47	CO <sub>2</sub> .....	8.08	.....	.....	.....
FeO.....	.27	.....	.....	.43	SO <sub>3</sub> .....	.....	.14	.14	.....
MgO.....	2.56	.20	.19	.....	S.....	.....	.....	.....	.05
CaO.....	9.39	.14	.22	.....	MnO.....	.....	None	None	.17
Na <sub>2</sub> O.....	.10	Trace	.14	.....		100.02	100.31	100.27	97.41
K <sub>2</sub> O.....	2.43	.46	.18	.....	Loss on ignition.....	.....	.....	.....	10.04
H <sub>2</sub> O.....	8.23	3.72	3.53	2.04					
H <sub>2</sub> O+.....				6.89					
TiO <sub>2</sub> .....	.....	.55	.26	.73					

ARKANSAS

A. Nonplastic kaolinitic clay from Upper Cretaceous Tokio formation, sec. 24, T. 8 S., R. 25 W., 5 miles southeast of Murfreesboro, Pike County, submitted by C. S. Ross. Analysis by George Steiger, record C-600.

SiO <sub>2</sub> .....	47.42	CaO.....	None	TiO <sub>2</sub> .....	1.49
Al <sub>2</sub> O <sub>3</sub> .....	36.52	Na <sub>2</sub> O.....	0.30	P <sub>2</sub> O <sub>5</sub> .....	.09
Fe <sub>2</sub> O <sub>3</sub> .....	.58	K <sub>2</sub> O.....		CO <sub>2</sub> .....	None
FeO.....	.10	H <sub>2</sub> O.....	.87		
MgO.....	.11	H <sub>2</sub> O+.....	12.23		99.71

B-P. Samples, more or less bauxitic, collected by M. N. Bramlette in a survey for bauxite. They represent two well sections in Saline County. B-K, well C-1, sec. 18, T. 2 S., R. 13 W; L-P, well C-3, sec. 12, T. 2 S., R. 14 W. Analyses by R. E. Stevens, record D-391.

	Feet		Feet		Feet		Feet
B.....	141-143	F.....	149-151	J.....	157-159	N.....	122-124
C.....	143-145	G.....	151-153	K.....	159-161	O.....	124-127
D.....	145-147	H.....	153-155	L.....	118-120	P.....	127-130
E.....	147-149	I.....	155-157	M.....	120-122		



	B	C	D	E	F	G	H	I
SiO <sub>2</sub> .....	38.00	33.88	17.00	14.25	15.90	24.21	30.62	19.89
Al <sub>2</sub> O <sub>3</sub> .....	36.32	38.34	39.92	43.72	44.78	43.00	41.68	42.69
Fe <sub>2</sub> O <sub>3</sub> .....	2.35	6.82	14.53	12.30	10.80	7.88	5.86	10.76
H <sub>2</sub> O below 160°.....	.75	.69	.89	.76	.68	.85	.73	.91
H <sub>2</sub> O above 160°.....	15.90	18.22	24.54	25.01	25.52	20.92	18.61	22.76
TiO <sub>2</sub> .....	1.98	1.50	1.69	2.04	1.98	1.89	1.73	2.16
	95.30	99.45	98.59	98.08	99.66	98.75	99.23	99.17

  

	J	K	L	M	N	O	P
SiO <sub>2</sub> .....	31.21	38.60	14.35	7.15	9.78	28.38	33.72
Al <sub>2</sub> O <sub>3</sub> .....	39.11	37.75	42.40	52.77	41.30	36.81	33.15
Fe <sub>2</sub> O <sub>3</sub> .....	6.82	3.97	13.61	8.44	17.99	11.93	12.39
H <sub>2</sub> O below 160°.....	.95	.74	1.24	.62	.82	.70	.82
H <sub>2</sub> O above 160°.....	17.60	15.06	26.09	29.83	28.09	19.81	17.83
TiO <sub>2</sub> .....	1.92	1.92	1.40	1.32	1.61	1.15	1.05
	97.61	98.04	99.09	100.13	99.59	98.76	98.96

Q-V. A second series of samples of bauxite ore taken later by M. N. Bramlette. Analyses by R. E. Stevens, record D-454.

Q. Drill hole B-5, depth 74-76 feet, northwest corner, sec. 2, T. 2 S., R. 14 W., Saline County.

R. Drill hole B-5, depth 76-78 feet, same locality.

S. Drill hole B-5, depth 78-80 feet, same locality.

T. Drill hole B-5, depth 80-83 feet, same locality.

U. Outcrop sample, old Calumet mine, sec. 26, T. 2 S., R. 14 W., Saline county.

V. Outcrop sample, sec. 12, T. 1 S., R. 13 W., Pulaski County.

	Q	R	S	T	U	V
SiO <sub>2</sub> .....	15.72	4.73	5.74	9.43	10.35	22.48
Al <sub>2</sub> O <sub>3</sub> .....	51.00	58.03	58.60	52.00	56.58	47.68
Fe <sub>2</sub> O <sub>3</sub> .....	2.73	2.77	2.57	5.83	2.23	2.47
H <sub>2</sub> O.....	1.44	.63	.15	.42	.22	.52
H <sub>2</sub> O+.....	26.35	31.31	30.70	26.71	29.03	22.27
TiO <sub>2</sub> .....	2.25	2.46	2.06	4.08	1.79	2.55
	99.49	99.93	99.82	98.47	100.20	97.97

#### CALIFORNIA

Clays submitted by different persons.

A, B. Two bentonitic clays collected by H. W. Hoots. Analyses by J. G. Fairchild, record C-976.

A. Sample from 4- to 5-foot bed in Tejon formation, San Emigdio foothills, sec. 19, T. 10 N., R. 19 W.

B. Sample from Muddy Creek, San Emigdio grant, NW¼ sec. 18, T. 10 N., R. 22 W. Selenite present.

C. Bentonite from north flank of Santa Monica Mountains, Los Angeles County, collected by M. N. Bramlette. Analysis by Charles Milton, record D-181.

D. Claylike rock from drill hole on potash permit L. A. 047660, SW¼ sec. 27, T. 11 N., R. 2 W., S. B. M., collected by B. W. Dyer. Analysis by R. K. Bailey, record D-127.

E. Bentonitic clay from Death Valley, submitted by C. S. Ross. Analysis by R. E. Stevens, record D-364.

	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> .....	65.44	63.76	50.03	64.80	33.02	H <sub>2</sub> O+.....	3.58	4.38	7.52	-----	5.44
Al <sub>2</sub> O <sub>3</sub> .....	14.16	12.28	16.75	16.50	19.50	TiO <sub>2</sub> .....	.40	.36	.65	-----	.13
Fe <sub>2</sub> O <sub>3</sub> .....	2.89	2.52	5.83	-----	2.33	P <sub>2</sub> O <sub>5</sub> .....	-----	-----	-----	0.24	-----
FeO.....	-----	-----	.47	-----	.13	SO <sub>3</sub> .....	-----	2.34	-----	-----	-----
MgO.....	2.05	2.35	2.78	1.70	4.04	MnO.....	-----	-----	.01	-----	-----
CaO.....	1.42	2.16	1.20	1.10	.80	BaO.....	-----	-----	.16	-----	-----
Na <sub>2</sub> O.....	2.30	1.33	.26	-----	3.80	Ignition.....	-----	-----	-----	2.80	-----
K <sub>2</sub> O.....	1.35	1.40	.60	11.60	.16						
H <sub>2</sub> O.....	5.68	7.16	13.53	-----	11.69		99.27	100.04	100.03	98.50	100.04

<sup>1</sup> Contains a little Fe<sub>2</sub>O<sub>3</sub>.

<sup>2</sup> Total Fe.



## COLORADO

A. Clay residue from limestone at Moffat tunnel, separated by T. S. Lovering. Analysis by J. G. Fairchild, record C-989.

B. Sample of clay, probably bentonitic, from Westcliff, submitted by C. S. Ross. Analysis by R. E. Stevens, record D-364. See Montmorillonite, Q, p. 107.

	A	B		A	B
SiO <sub>2</sub> .....	58.27	54.77	K <sub>2</sub> O.....	4.96	0.25
Al <sub>2</sub> O <sub>3</sub> .....	20.30	15.88	TiO <sub>2</sub> .....	-----	.17
Fe <sub>2</sub> O <sub>3</sub> .....	3.00	.58	H <sub>2</sub> O-.....	3.85	9.26
FeO.....	.23	.62	H <sub>2</sub> O+.....	5.04	10.25
MgO.....	1.79	4.99			
CaO.....	.82	2.08		100.17	99.91
Na <sub>2</sub> O.....	1.91	1.06			

## FLORIDA

Bentonitic clay collected by A. C. Munyan 1.4 miles west of Marianna. Analysis by J. G. Fairchild, record D-467.

SiO <sub>2</sub> .....	55.40	Na <sub>2</sub> O.....	0.02	P <sub>2</sub> O <sub>5</sub> .....	0.04
Al <sub>2</sub> O <sub>3</sub> .....	23.68	K <sub>2</sub> O.....	1.73	MnO.....	.01
Fe <sub>2</sub> O <sub>3</sub> .....	3.76	H <sub>2</sub> O.....	5.50		
MgO.....	1.09	H <sub>2</sub> O+.....	8.00		100.06
CaO.....	.05	TiO <sub>2</sub> .....	.78		

## IOWA

Clay residue from a limestone, prepared by C. S. Ross in a study of the disintegration of limestone. Analysis by J. G. Fairchild, record C-992.

SiO <sub>2</sub> .....	61.70	CaO.....	Trace?	H <sub>2</sub> O+.....	5.24
Al <sub>2</sub> O <sub>3</sub> .....	17.75	Na <sub>2</sub> O.....	0.32	TiO <sub>2</sub> .....	.75
Fe <sub>2</sub> O <sub>3</sub> .....	3.52	K <sub>2</sub> O.....	6.66		
MgO.....	2.71	H <sub>2</sub> O-.....	1.18		99.83

## LOUISIANA

Two samples of so-called paraffin earth from Iberia Parish, collected by E. W. Shaw. Analyses by R. C. Wells, record 3161.

	A	B		A	B
H <sub>2</sub> O at 130°.....	55.46	56.71	Na <sub>2</sub> O.....	0.20	-----
Ignition above 130°.....	13.38	12.73			
SiO <sub>2</sub> .....	21.33	21.20		99.63	99.07
Fe <sub>2</sub> O <sub>3</sub> .....	1.73	1.67			
Al <sub>2</sub> O <sub>3</sub> .....	6.09	5.86	Combined C.....	3.13	-----
CaO.....	.36	.43	SiO <sub>2</sub> soluble in 5 percent NaOH.....	.92	-----
MgO.....	.31	.47	Organic matter soluble in gasoline.....	.01	-----
K <sub>2</sub> O.....	.77	-----			

## MAINE

Bottom samples from the Gulf of Maine, collected by the U. S. Bureau of Fisheries, and submitted by T. W. Vaughan. Five typical analyses by J. G. Fairchild, from record C-407.

	A	B	C	D	E
Soluble in HCl:					
SiO <sub>2</sub> .....	0.7	0.8	0.4	0.5	1.2
(Al,Fe) <sub>2</sub> O <sub>3</sub> .....	2.9	3.5	1.4	2.5	6.8
CaO.....	.3	.4	1.0	.8	.5
MgO.....	.6	.7	.3	.4	1.3
Insoluble.....	90.0	84.5	83.7	91.8	79.5



## MISSISSIPPI

A. Bauxitic clay from Tippah County, collected by E. F. Burchard on the land of W. T. Meadows, SW $\frac{1}{4}$  sec. 36, T. 3 S., R. 2 W.

B. Ferruginous clay or laterite from Pontotoc County, collected by E. F. Burchard on the land of Joe Gregory, sec. 36, T. 9 S., R. 1 E. Analyses A and B by George Steiger, record D-351.

	A	B		A	B
SiO <sub>2</sub> .....	29.08	6.38	H <sub>2</sub> O+.....	13.14	20.63
Al <sub>2</sub> O <sub>3</sub> .....	20.93	32.03	TiO <sub>2</sub> .....	1.04	2.32
Fe <sub>2</sub> O <sub>3</sub> .....	33.00	37.77		99.49	100.47
H <sub>2</sub> O-.....	2.30	1.34			

C-K. Bauxitic clay from Mississippi, collected by E. F. Burchard and described in Bull. 750, pp. 101-145, 1925. Analyses by J. G. Fairchild, record C-482.

C. Kemper County.

D. Pontotoc County.

E. Tippah County.

F. Tippah County, 6 miles west of Ripley.

G. Tippah County, 1 mile northwest of Blue Mountain.

H. Siderite and pisolitic bauxite, Union County.

I. Pisolites of bauxite chipped from F.

J. Winston County near Betheden.

K. Winston County near Fern Spring. Samples J and K are mixed with clay.

	C	D	E	F	G	H	I	J	K
SiO <sub>2</sub> .....	20.86	28.61	2.78	47.32	60.68	2.88	8.10	52.57	44.19
Al <sub>2</sub> O <sub>3</sub> .....	49.93	46.27	59.58	36.18	15.66	27.83	38.55	31.35	37.59
Fe <sub>2</sub> O <sub>3</sub> .....	1.37	1.46	1.72	1.08	6.40	1.78	3.35	2.27	.77
FeO <sup>1</sup> .....	None	None	None	None	None	27.58	15.29	None	None
MgO.....	.10	Trace	.07	.07	1.75	.77	.51	Trace	Trace
CaO.....	None	None	None	None	.29	1.10	.51	None	None
H <sub>2</sub> O-.....	1.16	.62	.36	.49	5.56	( <sup>2</sup> )	.73	.48	.54
H <sub>2</sub> O+.....	23.38	20.56	31.98	13.19	6.18	15.55	19.63	11.80	13.64
TiO <sub>2</sub> .....	3.00	2.50	3.60	1.60	1.00	2.00	2.80	1.60	3.20
MnO.....	Trace	Trace	Trace	Trace	Trace	1.53	.75	Trace	Trace
CO <sub>2</sub> .....	Trace	None	None	None	None	19.13	10.84	None	None
	99.80	100.02	100.09	99.93	<sup>3</sup> 97.52	100.15	101.06	100.07	99.93
Specific gravity of lump....	2.316	1.585	2.050						

<sup>1</sup> FeO of FeCO<sub>3</sub>.

<sup>2</sup> Undetermined.

<sup>3</sup> About 2 percent of alkalis probably present.

## MISSOURI

A-E. Five diaspore clays collected by J. M. Hill in Franklin County. Diaspore identified as present by E. S. Larsen. Analyses by Chase Palmer, record 3224.

F. Diaspore product washed from D, apparently dehydrated before analysis.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	27.67	7.07	3.80	15.59	40.57	0.57
Al <sub>2</sub> O <sub>3</sub> .....	54.00	74.14	76.67	65.01	31.53	95.33
Fe <sub>2</sub> O <sub>3</sub> .....	.10	.27	.77	1.05	9.49	1.13
H <sub>2</sub> O-.....	.99	.10		.49	.76	
H <sub>2</sub> O+.....	10.68	13.80	13.59	13.44	11.89	.43
TiO <sub>2</sub> .....	3.09	4.35	4.84	3.39	5.61	2.53
	96.53	99.73	99.67	98.97	99.85	99.99



NEVADA

A, B. Composite sample of mud and clay from boring, Black Rock Desert. Analysis by R. K. Bailey, record 2916. A, Total analysis; B, soluble portion.

A			B		
SiO <sub>2</sub> .....	43.58	P <sub>2</sub> O <sub>5</sub> .....	0.46	Cl.....	43.48
Al <sub>2</sub> O <sub>3</sub> .....	8.23	SO <sub>3</sub> .....	1.25	SO <sub>4</sub> .....	10.37
Fe <sub>2</sub> O <sub>3</sub> .....	3.57	Cl.....	3.55	CO <sub>2</sub> .....	5.06
MgO.....	2.68	MnO.....	.18	HCO <sub>3</sub> .....	
CaO.....	7.34	B <sub>2</sub> O <sub>3</sub> .....	.69	B <sub>2</sub> O <sub>7</sub> .....	1.42
Na <sub>2</sub> O.....	10.15			SiO <sub>2</sub> .....	1.34
K <sub>2</sub> O.....	2.90		100.23	Na.....	37.35
H <sub>2</sub> O.....	4.66	Less O.....	.80	K.....	.98
H <sub>2</sub> O+.....	5.86				
CO <sub>2</sub> .....	5.13		99.43		100.00

C-I. Seven surface muds from Columbus Marsh. Composition of portion soluble in water. Analyses by W. B. Hicks, record 2934.

	C	D	E	F	G	H	I
Cl.....	40.30	53.30	48.15	49.20	34.15	53.20	45.40
SO <sub>3</sub> .....	21.30	2.31	4.15	5.78	4.44	3.45	2.92
B <sub>2</sub> O <sub>7</sub> .....	1.14	2.21	1.45	6.21	25.88	3.30	3.01
CO <sub>2</sub> .....	None	None	4.67	.75	.92	None	4.93
SiO <sub>2</sub> .....	.23	3.20	2.60	.43	1.53	1.30	4.80
K.....	.58	.60	.47	.51	1.91	2.08	.67
Ca.....	5.89	None	None	.37	2.72	.29	None
Na.....	30.56	38.48	38.51	36.75	28.45	36.38	38.27
Mg.....	None	Trace	Trace	None	None	None	None
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Soluble.....	18.26	11.27	20.00	11.75	6.53	7.24	10.96

PENNSYLVANIA

- A. Clay shale from Antes Fort, sold as "rottenstone."
- B. Similar material from Hull, England, analyzed for comparison.
- C. Welsh "rottenstone." Analyses A-C by W. T. Schaller, record C-445.
- D. Fire clay, submitted by C. S. Ross. Analysis by R. C. Wells, record C-942.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	52.5	67.6	70.4	33.99	TiO <sub>2</sub> .....				None
Al <sub>2</sub> O <sub>3</sub> .....	26.9	13.8	14.7	44.54	CO <sub>2</sub> .....	None	None	None	None
Fe <sub>2</sub> O <sub>3</sub> .....					Rest, probably mostly alkalies.....				11.7
CaO.....	.7	1.2	Trace	.21					
MgO.....	2.5	Lost	.7	.12					
Ignition.....	5.7	7.3	6.6	20.57		100.0	100.0	100.0	99.81

SOUTH DAKOTA

Bentonite from Ardmore used in making "refinite", submitted by J. Middleton. Analyses by W. T. Schaller, record C-207.

- A. Natural clay, which swells only slightly in water.
- B. "Refinite."

	A	B		A	B		A	B
SiO <sub>2</sub> .....	51.64	46.80	CaO.....	2.18	3.36	TiO <sub>2</sub> .....	(1)	(1)
Al <sub>2</sub> O <sub>3</sub> .....	18.25	18.44	Na <sub>2</sub> O.....	2.09	3.69	CO <sub>2</sub> .....	(1)	(1)
Fe <sub>2</sub> O <sub>3</sub> .....	1.24	2.10	K <sub>2</sub> O.....	.12	.18			
FeO.....	1.40	.34	H <sub>2</sub> O.....	13.22	12.12		99.88	98.69
MgO.....	3.41	4.05	H <sub>2</sub> O+.....	6.33	7.61			

<sup>1</sup> Present.



## TENNESSEE

"Residual" clay from marble of Blount County. Partial analysis by Chase Palmer, record 2981.

SiO <sub>2</sub> .....	21.32	CaO.....	26.81	CO <sub>2</sub> .....	19.83
Al <sub>2</sub> O <sub>3</sub> .....	14.30	H <sub>2</sub> O-.....	} 3.54		
Fe <sub>2</sub> O <sub>3</sub> .....	8.09	H <sub>2</sub> O+.....			93.89
MgO.....	None	MnO.....	None		

## TEXAS

A. Glauconitelike material from Mills service station, Loves Lookout, Cherokee County.

B. Glassy volcanic ash from Post City. Samples A-B submitted by C. S. Ross. Analyses by J. G. Fairchild, record D-289.

C. Bentonitic clay 0.8 mile east of South Bosque, McLennon County, collected by L. W. Stephenson. Analysis by J. G. Fairchild, record C-1077.

D. Surface crust of soil from Posey Saline, Anderson County, collected by Julia Gardner. Analysis by J. G. Fairchild, record C-639.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	26.40	72.74	51.87	80.21	H <sub>2</sub> O-.....	3.70	-----	0.81	} 10.27
Al <sub>2</sub> O <sub>3</sub> .....	16.80	11.84	26.80	5.16	H <sub>2</sub> O+.....	11.65	4.62	12.61	
Fe <sub>2</sub> O <sub>3</sub> .....	18.40	.51	-----	2.30	TiO <sub>2</sub> .....	.23	.15	-----	
FeO.....	19.35	1.17	1.42	-----	P <sub>2</sub> O <sub>5</sub> .....	.28	-----	-----	
MgO.....	2.70	.40	4.42	Trace	SO <sub>3</sub> .....	-----	-----	.73	-----
CaO.....	None	.54	1.90	.4C					
Na <sub>2</sub> O.....	Trace	2.24	.03	} 1.00					
K <sub>2</sub> O.....	.52	6.05	.09				100.03	100.26	100.68

## UTAH

Five muds from Salduro Salt Marsh. Partial analysis of soluble matter by R. K. Bailey, record 2960.

	A	B	C	D	E
K.....	2.25	2.64	1.82	2.36	3.48
Cl.....	47.77	55.84	54.27	49.65	56.67
SO <sub>4</sub> .....	13.86	3.65	5.41	13.14	3.55
Soluble salts.....	14.55	13.00	13.98	15.36	11.72
H <sub>2</sub> O in mud.....	6.01	5.79	5.12	5.93	6.75

## VIRGINIA

A. Under-water marine sediment from Chincoteague Bay, collected and analyzed by E. T. Erickson, record D-288.

SiO <sub>2</sub> .....	76.32	MgO.....	0.77	SO <sub>3</sub> .....	0.31
Fe <sub>2</sub> O <sub>3</sub> .....	1.08	Na <sub>2</sub> O.....	1.65	Loss at 100°.....	1.55
Al <sub>2</sub> O <sub>3</sub> .....	10.69	K <sub>2</sub> O.....	1.90	Further loss on ignition.....	3.34
TiO <sub>2</sub> .....	.46	NaCl.....	.88		
P <sub>2</sub> O <sub>5</sub> .....	.07	MnO.....	.02		100.50
CaO.....	1.46				

B-D. Three clays of the beidellite type collected by C. S. Ross. Analyses by R. C. Wells; B, C, record D-268; D, record D-468.

B. Morefield pegmatite mine, Amelia.

C. Fracture filling in pegmatite, Roseland.

D. Claylike material containing cobalt from mine of Southern Mineral Products Co., Amherst County.

	B	C	D		B	C	D
SiO <sub>2</sub> .....	37.93	44.23	29.41	TiO <sub>2</sub> .....	2.70	1.01	0.76
Al <sub>2</sub> O <sub>3</sub> .....	28.10	31.30	28.97	CO <sub>2</sub> .....	-----	-----	None
Fe <sub>2</sub> O <sub>3</sub> .....	13.60	5.77	12.20	NiO.....	-----	-----	.03
FeO.....	None	Trace	-----	CoO.....	-----	-----	1.51
MgO.....	.72	.18	.18	MnO.....	-----	-----	6.75
CaO.....	.15	.45	.60	Li <sub>2</sub> O.....	-----	-----	None
K <sub>2</sub> O.....	.71	.95	.26	CuO.....	-----	-----	None
Na <sub>2</sub> O.....	.06	.19	.18	O.....	-----	-----	1.53
H <sub>2</sub> O-.....	4.52	3.97	4.65				
H <sub>2</sub> O+.....	11.92	12.05	13.13		100.41	100.10	100.16



## WASHINGTON

Five clays submitted by F. H. Knowlton. Approximate partial analyses by J. G. Fairchild, record C-408.

A. Corner 13th and Perry Streets, Spokane, represents bank 40 feet high.

B. Half a mile north of Mica, Spokane County. From well, beds probably 10 feet thick or more.

C. Schuele's ranch, south of Fivemile Prairie, Spokane County. Represents beds 20 feet thick or more.

D. Spokane, Portland & Seattle Railway cut west of Latah Creek, Spokane County. Represents beds 20 feet thick or more.

	A	B	C	D	E
SiO <sub>2</sub> .....	64.00	57.00	70.00	56.00	45.00
Al <sub>2</sub> O <sub>3</sub> .....	20.00	15.00	19.00	23.00	30.00

## WYOMING

A-C. Bentonitic clays collected by W. W. Rubey. Analyses by J. G. Fairchild, records C-870 and C-941.

A. From top of Mowry shale at Clay Spur.

B. From lower part of Belle Fourche shale, member of Graneros shale, at Osage, about 20 feet above Clay Spur bentonite.

C. From lower part of Pierre shale, mine near Pedro.

D. Bentonite from Big Horn Basin, collected by C. T. Lupton. Analysis by George Steiger, record 3085.

E. Bentonite from NW $\frac{1}{4}$  sec. 30, T. 47 N., R. 63 W., Weston County, collected by D. F. Hewett. Analysis of fine portion only by George Steiger, record 3181.

F. Bentonite from Upton collected by C. S. Ross. Analysis by J. G. Fairchild, record C-993.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	70.98	53.50	56.93	56.96	54.31	55.44
Al <sub>2</sub> O <sub>3</sub> .....	<sup>1</sup> 11.47	<sup>1</sup> 21.57	<sup>1</sup> 14.75	19.46	20.22	20.14
Fe <sub>2</sub> O <sub>3</sub> .....	<sup>2</sup> 2.48	<sup>2</sup> 3.28	<sup>2</sup> 2.08	3.60	1.88	3.67
FeO.....				.16	.19	.30
MgO.....	1.38	1.89	1.86	1.77	.98	2.49
CaO.....	.26	1.25	6.35	2.06	.94	.50
Na <sub>2</sub> O.....	1.69	1.94	2.28	.86	2.35	2.75
K <sub>2</sub> O.....	.75	1.04	.93	.87	.21	.60
H <sub>2</sub> O.....	} 11.32	} 15.20	} 10.61	{ 7.85	{ 13.18	} 14.70
H <sub>2</sub> O+.....						
TiO <sub>2</sub> .....	.10	.11		.16	.07	.10
CO <sub>2</sub> .....	None	None	4.61			
MnO.....				.10		
	100.43	99.78	100.40	100.49	99.79	100.69

<sup>1</sup> Includes any P<sub>2</sub>O<sub>5</sub>.

<sup>2</sup> FeO probably absent.

## MISCELLANEOUS LOCALITIES

A, B. Marine sediments collected by the *Challenger* expedition. CaCO<sub>3</sub> determined by George Steiger, record C-326. Colloids by W. O. Robinson and noncolloids determined by W. H. Fry, of the Bureau of Soils. A, red clay; B, blue mud.

	A	B
Colloids.....	63.3	66.5
Noncolloids.....	16	22
CaCO <sub>3</sub> .....	8.8	9.2



C-H. Samples of ocean-bottom mud submitted by T. W. Vaughan. Analyses by J. G. Fairchild, record C-303 and C-543. A few representative analyses have been selected for purposes of reference. See Carnegie Inst. Washington Papers from Dept. Marine Biology, vol. 23, 1926.

C. Atlantic, latitude 28°7', longitude 74°14'.

D. Caribbean, latitude 16°48', longitude 75°51'.

E. Pacific, latitude 7°24', longitude 79°14'.

F. Pacific, latitude 5°48', longitude 79°39'. C-F collected by Coast and Geodetic Survey steamer *Surveyor*.

G. Pago Pago Harbor, Samoa. Described by M. N. Bramlette in Carnegie Inst. Washington Papers from Dept. Marine Biology, vol. 23, p. 3, 1926.

H. Nuuli Lagoon, Samoa, near center.

	C	D	E	F	G	H
Soluble:						
SiO <sub>2</sub> .....	1.07	0.87	-----	0.93	0.97	0.57
Fe <sub>2</sub> O <sub>3</sub> .....	3.70	1.12	6.61	4.34	} 14.72	{ .97 1.42
Al <sub>2</sub> O <sub>3</sub> .....	2.93	.94	5.62	5.12		
CaO.....	22.50	45.45	1.65	1.23		
MgO.....	1.90	.74	2.30	2.28	2.03	2.92
P <sub>2</sub> O <sub>5</sub> .....	.12	.07	-----	.12	.43	.13
K <sub>2</sub> O.....	.63	.20	-----	-----	-----	-----
Na <sub>2</sub> O.....	1.39	3.39	-----	-----	-----	-----
MnO.....	-----	-----	Trace	-----	-----	-----
CO <sub>2</sub> .....	-----	-----	-----	-----	(9)	40.30
Insoluble:						
SiO <sub>2</sub> .....	32.21	8.39	53.30	56.82	32.55	1.27
Fe <sub>2</sub> O <sub>3</sub> .....	} 10.01	} 4.83	} 3.13	} 3.42	} 26.42	} 1.34
Al <sub>2</sub> O <sub>3</sub> .....						
CaO.....	.43	-----	15.82	.76	1.13	-----
MgO.....	.28	-----	-----	.83	.90	-----
K <sub>2</sub> O.....	2.05	-----	-----	.89	1.58	-----
Na <sub>2</sub> O.....	.35	-----	-----	.91	1.58	2.10
Ignition.....	-----	-----	-----	-----	1.58	2.10

<sup>1</sup> Includes a little TiO<sub>2</sub>.

<sup>2</sup> Contains much organic matter.

<sup>3</sup> Contains some TiO<sub>2</sub>.

### ANALYSES OF ORES AND GANGUE MATERIAL

Many partial analyses and routine determinations of metals, phosphates, ores, hydrocarbons, brines, potash salts, coals, minerals, mine waters, oils, nitrates, and miscellaneous substances have been made in the Survey laboratory, which do not need to be reported here, as they have little interest beyond answering some particular question. There are a few analyses, however, mostly of iron and manganese ores or gangue minerals, which show the usual composition of such materials, and these are given below. But if the material analyzed was chiefly of geochemical interest, on the one hand, or a mineralogical specimen, on the other hand, its analysis is given under one of the other headings.

#### ALABAMA

A-E. Iron ores collected by E. F. Burchard.

A, B, Clinton iron ores; analyses by R. C. Wells, record 3111. A, Crudup; B, Greasy Cove.

C-E from the Russellville district; analyses by J. G. Fairchild, record D-279. C, Small pebble of brown ore; D, selected pebble for composite analysis; E, porous brown iron ore.

F. Ore from Kent Mountain area. Analysis by Charles Milton, record D-284.

G. Low-grade brown iron ore, clay replacement type, from Penny Hollow, sec. 33, T. 6 S., R. 12 W., Franklin County. Analysis by George Steiger, record D-351.



	A	B	C	D	E	F	G
SiO <sub>2</sub> -----	27.67	7.56	14.44	12.44	4.88	4.97	136.03
Al <sub>2</sub> O <sub>3</sub> -----	10.39	4.14	13.69	11.38	1.41	3.74	1.75
Fe <sub>2</sub> O <sub>3</sub> -----	42.15	54.10	57.90	62.02	80.72	81.78	52.10
FeO-----				.18	.18	.66	
MgO-----			None	None	None	.04	
CaO-----	5.93	12.52	.05	.05	None	.04	
K <sub>2</sub> O-----	2.56	.17					
H <sub>2</sub> O-----			1.32	1.50	1.41	7.37	1.35
H <sub>2</sub> O+-----			11.92	11.73	11.34		
TiO <sub>2</sub> -----	.62	.41	.76	.60	None	.32	8.08
CO <sub>2</sub> -----				.10	.10	.08	.29
P <sub>2</sub> O <sub>5</sub> -----	.84	.71	.10	.03	.34	.85	
S-----	.07			None	None		
MnO-----	.04	.07	.25	.09	.15	.14	
	90.27	79.68	100.43	100.12	100.53	99.99	99.60

<sup>1</sup> Insoluble.

H-L. Five samples of iron ore collected by E. F. Burchard. H-K are noteworthy on account of their high manganese content, a small quantity of cobalt, and traces of lead and copper not determined. Analyses H-K, by Charles Milton, record D-479; L by R. E. Stevens, record D-429.

H, I. Cherokee County, sec. 9, T. 12 S., R. 11 E., lands of W. C. Pope.

J. About 3 miles south of Spring Garden.

K. Cherokee County.

L. Russellville district, sec. 24, T. 6 S., R. 12 W.

	H	I	J	K	L		H	I	J	K	L
SiO <sub>2</sub> -----	3.68	6.50	4.27	20.04	5.81	Ni-----	0.16				
Al <sub>2</sub> O <sub>3</sub> -----	12.67	19.37	13.11	15.42	3.00	P-----	.24	0.18	0.12	0.12	0.59
Mn-----	34.99	28.01	33.44	29.12	.12	S-----	None	None	Trace	None	.07
Fe-----	2.05	5.14	5.90	2.42	54.52	BaO-----	8.45	1.20	5.78	2.42	
Co-----	1.73	4.13	2.47	2.94		TiO <sub>2</sub> -----					.06

M, N. Graphitic schists from Ashland, collected by E. S. Bastin. Determinations by A. A. Chambers, record 3120.

M. Composite of 30 samples from Southern Graphite Co. Graphite, 3.24 percent.

N. Composite of 35 samples from Standard Graphite Co. Graphite, 3.84 percent.

CALIFORNIA

Samples of natroalunite rock from Funeral Range, near Death Valley. Analyses by R. K. Bailey, record 3024. A, Hard rock near surface; B, soft rock 60 feet down.

	A	B		A	B
SiO-----	7.46	10.27	H <sub>2</sub> O-----	14.87	17.60
Al <sub>2</sub> O <sub>3</sub> -----	39.02	38.46	SO <sub>2</sub> -----	30.52	25.03
Na <sub>2</sub> O-----	5.27	6.83			
K <sub>2</sub> O-----	3.05	1.04		100.19	99.23

COLORADO

A. Breccia from Cresson mine, Cripple Creek, collected by G. F. Loughlin. Analysis by R. C. Wells, record C-871.

Soluble in acid		Insoluble in acid	
H <sub>2</sub> O-----	0.66	FeS <sub>2</sub> -----	4.32
H <sub>2</sub> O+-----	.55	SiO <sub>2</sub> -----	46.78
SO <sub>3</sub> -----	.41	K <sub>2</sub> O-----	6.92
SiO <sub>2</sub> -----	.70	Na <sub>2</sub> O-----	3.70
CO <sub>2</sub> -----	8.30	FeO-----	None
FeO-----	1.94	Fe <sub>2</sub> O <sub>3</sub> -----	.49
CaO-----	5.39	Al <sub>2</sub> O <sub>3</sub> -----	12.65
MgO-----	2.57	TiO <sub>2</sub> -----	.74
Al <sub>2</sub> O <sub>3</sub> -----	1.77	CaO-----	.50
MnO-----	.08	MgO-----	.65
		Se, Te-----	None
		ZrO <sub>2</sub> -----	0.08
		As-----	.22
		F-----	None
		Cl-----	.02
		S-----	.28
		BaO-----	.07
		P <sub>2</sub> O <sub>5</sub> -----	None
			99.79



B, C. Two samples from Alma district, Park County.

B. Carbonate gangue, ankerite, from Orphan Boy mine, submitted by B. S. Butler. Analysis by J. G. Fairchild, record C-1103.

C. Calcite from London mine, collected by G. F. Loughlin. Analysis by R. E. Stevens, record D-367.

	B	C		B	C
CaO.....	29.90	52.18	CO <sub>2</sub> .....	45.34	43.02
MgO.....	19.10	.26	Insoluble.....	2.36	-----
FeO.....	2.12	1.22			
MnO.....	1.00	1.87		100.04	98.55
H <sub>2</sub> O.....	.22	-----			

D. Sample of rock from dump, after gold extraction, Vindication Mining Co., Independence. Determination of potash by W. B. Hicks, record 3148. K<sub>2</sub>O, 12.08 percent.

#### CUBA

Four samples collected in a study of manganese ores by E. F. Burchard. Analyses by George Steiger, record C-59.

A-B. Abundancia mine, Manganoso, Oriente Province.

C. Three miles west of Vinales, Pinar del Rio Province.

D. Near Sabanilla, Oriente Province.

	A	B	C	D		A	B	C	D
Insoluble in HCl.....	58.39	29.25	25.09	53.16	Equivalent to—				
(Al, Fe) <sub>2</sub> O <sub>3</sub> .....	13.76	7.00	19.61	14.74	MnO <sub>2</sub> .....	9.16	47.80	30.79	0.80
CaO.....	3.60	4.12	16.83	3.40	Mn.....	5.79	30.23	19.46	.50
MgO.....	2.60	1.96	3.29	4.00	Loss on ignition.....	-----	-----	-----	24.76
MnO.....	7.48	39.01	25.13	.65					

#### FLORIDA

An examination of sand at Pablo Beach as a source of zirconium was made in 1918 by H. D. Smith, of the United States Bureau of Mines. Determinations of ZrO<sub>2</sub> by R. C. Wells, record C-97, were as follows: A, 0.4; B, 3.5; C, 2.3; D, 2.9.

#### HAITI

Manganese ore from Gros Marne, collected by W. S. Burbank. Partial analyses by J. G. Fairchild, record C-355: MnO, 33.3; Fe<sub>2</sub>O<sub>3</sub>, 1.52; P<sub>2</sub>O<sub>5</sub>, 0.13.

#### IDAHO

In the study of different ore deposits in Idaho "siderite" of somewhat variable composition has frequently been analyzed as a fairly abundant gangue mineral.

A-E. Five specimens collected by C. P. Ross in the Hailey and Casto quadrangles. Analyses by J. J. Fahey, record D-249.

A. Lydia tunnel, Mascot mine, Hailey quadrangle.

B. Tunnel 8, Lost Packer mine, Casto quadrangle.

C. Whale mine, Hailey quadrangle.

D. Sunset mine, Casto quadrangle.

E. Yellow Jacket mine, Casto quadrangle.

F-I. Four samples from Wood River district, collected and described by D. F. Hewett in Bulletin 814, 1930. Partial analyses by Chase Palmer, record 3018.

F. Near Narrow Gage shaft.

G. Jay Gould mine.

H. Wall rock, Minnie Moore mine.

I. Minnie Moore mine, associated with galena.

J. Armstead mine, Talache, submitted by Edward Sampson. Partial analysis by J. G. Fairchild, record C-348.

K. Ramshorn mine, Bayhorse quadrangle, collected by C. P. Ross. Analysis by J. J. Fahey, record D-236.



	A	B	C	D	E	F	G	H	I	J	K
Insoluble in HNO <sub>3</sub> .....	0.95	1.72	1.24	0.33	1.57						
Insoluble in HCl.....						0.72	0.61	26.03	4.39		
FeO.....	51.25	46.03	47.00	1.30	1.30	48.62	43.74	21.17	42.19	47.90	53.67
MnO.....	1.97	8.75	7.70	.01	.04	9.10	14.37	6.05	13.50	11.40	5.45
MgO.....	5.65	4.47	2.64	1.06	.73					1.10	2.14
CaO.....			1.73	53.43	52.95	.80	.79	15.38	.92	Trace	None
CO <sub>2</sub> (calculated).....	38.91	38.49	37.80	43.98	43.19	34.83	36.34	28.79	34.94	37.60	38.59
	98.73	99.46	98.11	100.02	99.78	94.07	95.85	97.42	95.94	98.00	99.85

MISSISSIPPI

A-C, samples of ore collected by E. F. Burchard. Analyses A-B by E. T. Erickson, record D-191; C by George Steiger, record D-351. D collected by O. B. Hopkins; analysis by R. C. Wells, record 3113.

A. Siderite, Blue Mountain.

B. Siderite, altering to limonite, associated with bauxite, Tippah County.

C. Ferruginous bauxite on the land of W. T. Meadows, sec. 36, T. 3 S., R. 2 W., Tippah County.

D. Ferruginous sandstone near Reform.

	A	B	C	D		A	B	C	D
Insoluble.....	1.27	11.37		41.3	H <sub>2</sub> O+				17.23
Soluble SiO <sub>2</sub> .....	.77	1.18			TiO <sub>2</sub> .....	None	0.12	1.24	
SiO <sub>2</sub> .....			9.95		CO <sub>2</sub> .....	36.83	29.56		
Al <sub>2</sub> O <sub>3</sub> .....	.12	.43	33.80		P <sub>2</sub> O <sub>5</sub> .....	.20	.03		
Fe <sub>2</sub> O <sub>3</sub> .....	.47	7.58	36.30	47.2	MnO.....	4.31	.62		
FeO.....	54.70	45.20			Loss at 200°.....	.41	1.14		
MgO.....	.26	.53				99.70	98.33	100.43	
CaO.....	.36	.57							
H <sub>2</sub> O.....			1.91						

NEVADA

A-C. Three gangue carbonates from Pioche district, submitted by J. L. Gillson. Analyses by J. G. Fairchild, record C-638.

D. Manganese ore from 10-inch streak in Surprise claim, Golconda, collected by J. T. Pardee, described in Bull. 710, pp. 236-237, 1920. Analysis by Chase Palmer, record C-140.

E-G. Manganese ore from Three Kids deposit, Las Vegas. Collected by D. F. Hewett. Partial analyses by J. G. Fairchild, record C-1122.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	0.21	0.05	0.16	4.70			
Fe <sub>2</sub> O <sub>3</sub> .....				12.00			
FeO.....	None	None	None				
MgO.....	.20	.70	.27				
CaO.....	55.77	55.33	54.66	1.99			
CO <sub>2</sub> (calculated).....	44.09	44.23	43.92				
MnO.....	.07	Trace	1.11	48.96	1.27	6.01	3.87
MnO <sub>2</sub> .....					46.31	42.93	44.26
O.....				6.95			
BaO.....				4.73			
PbO.....					1.31	.44	5.65
WO <sub>3</sub> .....				1.54			
	100.34	100.31	100.12	80.87			

H. Graphitic schist near Carson. Determination of graphite by A. A. Chambers, record 3086, gave 48.97 percent.

I. Sericite from talc gouge, Divide silver district, collected by Adolph Knopf and described in Bull. 715, p. 159, 1921. Analysis by J. G. Fairchild, record 3259.

SiO <sub>2</sub> .....	48.16	H <sub>2</sub> O.....	5.84
Al <sub>2</sub> O <sub>3</sub> .....	34.00	TiO <sub>2</sub> .....	.20
FeO.....	2.07		
K <sub>2</sub> O.....	9.62		99.89



J-L. Samples of alunite from different localities.

J. Black Eagle mine, Rawhide district. Analysis by W. B. Hicks, record 2967.

K. Railroad Pass; collected by Eugene Callaghan. Analysis by R. C. Wells, record D-341. On extracting the ignited rock with water on the steam bath the soluble alkalis amounted to: Na<sub>2</sub>O, 0.46; K<sub>2</sub>O, 3.01 percent.

L. Vein material near Sulphur, collected by E. S. Larsen. Slightly mixed with some other very finely crystallized material. Partial analysis by George Steiger, record 3217.

	J	K	L		J	K	L
SiO <sub>2</sub> -----	1.24	26.05	1.56	TiO <sub>2</sub> -----		0.33	-----
Al <sub>2</sub> O <sub>3</sub> -----	36.90	27.77	37.00	H <sub>2</sub> O-----	0.20	.38	-----
Fe <sub>2</sub> O <sub>3</sub> -----		1.39	-----	H <sub>2</sub> O+-----	14.17	9.52	-----
MgO-----	Trace	-----	.19	SO <sub>3</sub> -----	36.50	25.17	37.06
CaO-----	Trace	-----	1.44				
Na <sub>2</sub> O-----	2.32	.76	1.98		99.69	97.95	88.77
K <sub>2</sub> O-----	8.36	6.58	9.54				

#### NEW MEXICO

A. Kaolinite replacing quartz and sericite in a vein at Tyrone. Collected by Sidney Paige and described in Prof. Paper 122, 1922. Some pyrite is also present. Analysis by George Steiger, record 3211.

B. Limonite gossan from Magdalena district, collected by A. H. Koschmann. Analysis by R. E. Stevens, record D-451.

	A	B		A	B		A	B
SiO <sub>2</sub> -----	68.11	56.25	K <sub>2</sub> O-----	4.08	-----	SO <sub>3</sub> -----	-----	2.30
Al <sub>2</sub> O <sub>3</sub> -----	16.84	7.36	H <sub>2</sub> O-----	( <sup>1</sup> )	2.15	Cr <sub>2</sub> O <sub>3</sub> -----	-----	.06
Fe <sub>2</sub> O <sub>3</sub> -----	.80	15.32	H <sub>2</sub> O+-----	( <sup>1</sup> )	4.55	MnO-----	-----	1.92
FeO-----	3.53	None	F-----	.09	-----	BaO-----	-----	3.29
MgO-----	.50	.82	S-----	3.15	-----			
CaO-----	.44	1.70	TiO <sub>2</sub> -----	-----	.41		97.98	96.83
Na <sub>2</sub> O-----	.44	-----	P <sub>2</sub> O <sub>5</sub> -----	-----	.70	Insoluble in HCl	-----	70.38

<sup>1</sup> Undetermined.

#### NEW YORK

Graphitic schists collected by E. S. Bastin near Saratoga Springs. A determination by A. A. Chambers, record 3120, on a composite sample from 35 places on the property of the Graphite Products Corporation, gave graphite, 7.30 percent.

#### NORTH CAROLINA AND SOUTH CAROLINA

Six samples of altered rocks associated with gold-bearing lodes, collected by J. T. Pardee. Partial analyses by J. G. Fairchild, record D-453.

A. Blackmon mine, S. C. Green schist ore body.

B. Haile mine, S. C. Bumalo pit, gray banded schist.

C. Highway west of Yadkin River, Stanly County, N. C. Banded gray slate.

D. Brewer mine, S. C. Outcrop south of big pit.

E. Brewer mine, S. C. Outcrop in placer pit southwest of mill.

F. Highway 1 mile north of Waxhaw, N. C. Slate saprolite.

	A	B	C	D	E	F
SiO <sub>2</sub> -----	57.78	41.46	62.08	82.26	75.84	63.46
Al <sub>2</sub> O <sub>3</sub> (P <sub>2</sub> O <sub>5</sub> )-----	29.46	32.74	17.50	10.60	12.70	19.56
Fe <sub>2</sub> O <sub>3</sub> (total Fe)-----	.50	7.18	8.28	2.83	6.25	7.40
MgO-----	Trace	Trace	2.61	Trace	Trace	.72
CaO-----	Trace	Trace	1.48	Trace	Trace	Trace
TiO <sub>2</sub> -----	1.12	.74	.82	.30	.72	.56
K <sub>2</sub> O-----	7.26	9.18	3.06	2.88	3.21	3.04
	96.12	91.30	95.83	98.87	98.72	94.74



SOUTH DAKOTA

Manganese nodules from the Chamberlain district, collected by D. F. Hewett. Partial analyses by J. G. Fairchild, record C-1123. A, B, outer layers; Aa, Bb, inner layers.

	A	Aa	B	Bb
Mn.....	22.95	17.95	22.68	18.25
Fe.....	8.06	3.15	8.61	3.14

TENNESSEE

Low-grade brown iron ore, of clay replacement type, collected by E. F. Burchard at Wright mine, Lawrence County. Analysis by George Steiger, record D-351.

Insoluble.....	49.90	H <sub>2</sub> O+.....	7.86
Al <sub>2</sub> O <sub>3</sub> .....	1.60	TiO <sub>2</sub> .....	.25
Fe <sub>2</sub> O <sub>3</sub> .....	38.54		
H <sub>2</sub> O-.....	1.53		99.68

TEXAS

A-Q. Iron ore, mainly limonite, from Cass County, collected by E. B. Eckel. Analyses by J. J. Fahey, record D-375. CaO, MgO, and alkalis not determined.

A. Concord school district, 8 miles west of Linden, Cass County, in southwest corner of Linden quadrangle. Average of 10 pit samples. Limonite.

B. Same. Brown flinty laminated ore.

C. Surratt district, 4.5 miles north of Linden, Cass County. Low quality limonite.

D. Same. Typical good ore.

E. Northern part of Jernigan Hill, 5 miles S. 20° E. of Linden, Cass County. Picked quality concentrating ore.

F. Southern part of Jernigan Hill. Spongy cellular limonite.

G. Harris tract, 9 miles S. 30° E. of Linden, Cass County. Typical limonite ore, Trench F.

H. Same. Trench P.

I. Prewitt district, 6 miles S. 60° E. of Linden, Cass County. Good quality limonite.

J. Hickory Hill, 7.5 miles N. 25° W. of Atlanta, Cass County. "Buff crumbly" ore.

K. Waters tract, 6 miles N. 45° W. of Atlanta, Cass County. Typical ore.

L. Atlanta district, 1.5 miles N. 40° W. of Atlanta, Cass County. Limonite.

M. Bivins district, 1.5 miles west of Bivins, Cass County. Limonite.

N. Bowie Hill, east end, 7.5 north of Atlanta, Cass County. Typical ore.

O. Same, extreme western part.

P. Same, central part.

Q. Bivins district, 1.5 miles west of Bivins, Cass County. Limonite.

	A	B	C	D	E	F	G	H	I
SiO <sub>2</sub> .....	11.10	15.72	22.83	13.31	2.24	20.28	23.07	23.03	18.20
Al <sub>2</sub> O <sub>3</sub> .....	4.88	8.73	4.62	6.45	1.04	6.42	3.41	5.16	4.33
Fe <sub>2</sub> O <sub>3</sub> .....	70.28	61.44	61.15	66.47	85.62	61.52	60.87	58.33	64.52
H <sub>2</sub> O.....	12.80	13.39	10.83	13.11	10.72	12.01	11.33	11.67	10.88
TiO <sub>2</sub> .....	.17	.19	.16	.21	.07	.12	.16	.21	.18
CO <sub>2</sub> .....	None	.02	.02	.02	.50	.02	.02	.02	.02
P <sub>2</sub> O <sub>5</sub> .....	.24	.76	.22	.29	.15	.08	.18	.21	.25
S.....	.09	.03	.06	.06	.05	.05	.05	.03	.03
	99.56	100.28	99.89	99.92	100.39	100.50	99.09	98.66	98.41

	J	K	L	M	N	O	P	Q
SiO <sub>2</sub> .....	11.91	9.74	10.04	12.40	20.14	7.77	8.03	8.24
Al <sub>2</sub> O <sub>3</sub> .....	2.31	5.46	4.85	4.58	5.23	4.61	4.88	4.21
Fe <sub>2</sub> O <sub>3</sub> .....	70.41	71.22	70.91	70.71	61.28	74.67	74.16	74.57
H <sub>2</sub> O.....	12.81	11.90	12.82	12.46	12.11	12.46	12.90	13.10
TiO <sub>2</sub> .....	.15	.15	.15	.14	.15	.15	.15	.15
CO <sub>2</sub> .....	.02	.02	.50	.02	.02	.02	.02	.02
P <sub>2</sub> O <sub>5</sub> .....	.31	.22	.22	.17	.23	.21	.25	.17
S.....	.03	.03	.03	.05	.03	.03	.06	.05
	97.95	98.74	99.52	100.53	99.19	99.92	100.45	100.51



R-X. Iron ore from Cass, Marion, and Upshur Counties, collected by E. B. Eckel. Analyses by George Steiger, record D-375.  $\text{CO}_2$  was estimated at 0.1 to 0.3 percent in each sample. CaO and MgO also small if any.

R. Gilbert tract, Marion County,  $6\frac{1}{2}$  miles northeast of Ore City, Upshur County. Limonite ore, unwashed.

S. Southeastern part of Gilbert tract, Marion County. Light-brown flinty ore.

T. Small deposit 2.2 miles east of Hughes Springs, Cass County. Limonite.

U. Southeastern part of Morris County, 5 miles S.  $30^\circ$  W. of Hughes Springs. Limonite.

V. Southwestern part of Cass County, Cain farm, 5 miles S.  $10^\circ$  W. of Hughes Springs. Limonite.

W. Spring Hill area, 5 miles S.  $20^\circ$  E. of Hughes Springs, Cass County. Limonite.

X. Hill 1 mile N.  $55^\circ$  E. of Avinger, Cass County. Limonite.

	R	S	T	U	V	W	X
$\text{SiO}_2$ .....	9.72	21.33	12.64	10.96	19.60	3.08	19.53
$\text{Al}_2\text{O}_3$ .....	5.63	4.86	3.64	3.74	4.04	2.41	3.93
$\text{Fe}_2\text{O}_3$ .....	70.29	59.06	70.07	72.45	63.64	82.93	65.44
FeO.....	.51	.34	.14	.27	.40	.27	.40
$\text{H}_2\text{O}$ .....	1.30	1.98	1.12	1.07	1.12	.72	.82
$\text{H}_2\text{O}^+$ .....	12.38	11.52	11.55	10.90	10.53	10.60	9.76
$\text{TiO}_2$ .....	.19	.30	.22	.14	.11	.11	.09
$\text{P}_2\text{O}_5$ .....	.18	.14	.20	.19	.26	.11	.18
S.....	.13	.19	.06	.09	.07	.12	.10
MnO.....	.03	None	.10	.06	.07	.06	.02
	100.36	99.72	99.74	99.87	99.84	100.41	100.27

Y-II. Limonite from Cass, Marion, and Upshur Counties. Collected by E. B. Eckel. Analyses by E. T. Erickson, record D-375. The  $\text{Al}_2\text{O}_3$  may be a little high as only one reprecipitation of  $\text{Al}_2\text{O}_3$  was made.

Y. Daingerfield Hill, 1 mile west of Daingerfield, Morris County. Limonite.

Z. Hill  $2\frac{3}{4}$  miles N.  $45^\circ$  E. of Hughes Springs, Cass County. Limonite.

AA. Hill 2 miles N.  $30^\circ$  W. of Hughes Springs, Cass County. Limonite.

BB. Hill 2 miles N.  $70^\circ$  E. of Hughes Springs, Cass County. Limonite.

CC. Norwood Hill, north end, 4 miles N.  $65^\circ$  E. of Hughes Springs, Cass County. Limonite.

DD. Hooten Hill, 0.5 mile northeast of Hughes Springs, Cass County. Limonite.

EE. Veal's Switch, Morris County,  $2\frac{1}{2}$  miles northwest of Hughes Springs. Limonite.

FF. Prewitt tract,  $4\frac{1}{2}$  miles S.  $45^\circ$  E. of Linden, Cass County. Limonite.

GG. Road outcrop 0.9 mile west of Lanier, Cass County. Limonite with much sand.

HH. John Davis tract, 2 miles S.  $70^\circ$  W. of Linden, Cass County. Limonite.

II. Hagerty Hill on Cass and Marion County line, 8 miles north of Jefferson, Marion County. Limonite.

	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	II
$\text{SiO}_2$ .....	16.16	19.76	9.98	14.92	13.10	13.70	9.24	13.54	19.72	15.88	15.96
$\text{Al}_2\text{O}_3$ .....	3.48	4.42	6.38	4.94	7.65	6.13	5.88	5.26	3.99	3.91	4.51
$\text{Fe}_2\text{O}_3$ .....	67.88	62.30	72.20	68.82	66.23	66.73	69.40	70.16	64.01	68.69	67.45
MgO.....	.11	.16	.12	.21	.08	.14	.16	.11	.06	.04	.13
CaO.....	.02	.02	.10	None	.04	.08	.08	.06	.08	.06	.14
$\text{H}_2\text{O}$ .....	1.07	1.04	1.27	1.19	1.23	1.75	1.58	1.19	1.09	1.00	1.51
$\text{H}_2\text{O}^+$ .....	11.28	12.15	10.33	10.23	11.56	11.59	13.33	9.67	11.08	10.42	10.44
$\text{TiO}_2$ .....	.10	.30	.14	.14	.20	.16	.10	.10	.08	.08	.08
$\text{P}_2\text{O}_5$ .....	.56	.35	.14	.21	.46	.40	.28	.20	.13	.14	.26
S.....	.03	.03	.09	.10	.03	.04	.03	.04	.10	.04	.04
MnO.....	.01	.08	.03	.11	.05	.03	.02	.06	.06	.08	.09
	100.70	100.61	100.78	100.87	100.63	100.75	100.10	100.39	100.40	100.34	100.61



JJ-OO. Iron ore of mixed character from Morris and Cass Counties, collected by E. B. Eckel. Analyses JJ-LL by J. G. Fairchild; MM-OO by Charles Milton, both record D-375.

JJ. Outcrop in stream, 0.75 mile S. 60° W. of Lanier, Cass County. Greensand.

KK. Same, greensand indurated with carbonate.

LL. Well on Daingerfield Hill, 0.6 mile N. 45° W. of Daingerfield, Morris County. Fresh oolitic glauconite(?).

MM. Southeastern part of Morris County, 5 miles S. 30° W. of Hughes Springs, Cass County. Partly oxidized carbonate ore.

NN. Same as MM.

OO. Knight area, 1.5 miles west of Lanier, Cass County. Cleaned carbonate.

	JJ	KK	LL	MM	NN	OO
SiO <sub>2</sub> .....	39.39	24.48	13.47	15.60	11.69	4.07
Al <sub>2</sub> O <sub>3</sub> .....	16.83	5.59	8.20	3.09	1.22	.30
Fe <sub>2</sub> O <sub>3</sub> .....	8.09	7.74	13.20	13.38	47.65	5.23
FeO.....	15.38	35.70	37.26	37.95	19.06	55.30
MnO.....				.23	.23	.16
MgO.....	1.51		( <sup>1</sup> )	.37	.02	.03
CaO.....				.90	None	None
Na <sub>2</sub> O.....	.02	.02	None			
K <sub>2</sub> O.....	.45	.34	None			
H <sub>2</sub> O.....	11.41	5.00	9.42	4.16	8.06	.89
TiO <sub>2</sub> .....	.27	.40	.04			
S.....			.01		.01	.02
CO <sub>2</sub> .....	5.66	20.12	15.16	22.79	11.04	33.30
P <sub>2</sub> O <sub>5</sub> .....	.23	.25	.64	.94	.50	.20
	99.24	99.64	97.39	90.42	99.48	99.50

<sup>1</sup> Present.

PP-TT. Iron carbonate from Cass County, collected by E. B. Eckel. Analyses by J. J. Fahey, record D-375. CaO, MgO, and alkalis not determined.

PP. Surratt district, 4.5 miles north of Linden, Cass County. Average carbonate ore.

QQ. Same, picked carbonate ore.

RR. Surratt district, especially pure carbonate ore.

SS. Prewitt district, 6 miles S. 60° E. of Linden, Cass County. Cleaned carbonate ore.

TT. 1.7 miles S. 27° E. of Lanier, Cass County. Carbonate ore.

	PP	QQ	RR	SS	TT		PP	QQ	RR	SS	TT
SiO <sub>2</sub> .....	4.39	9.59	3.23	1.64	1.98	CO <sub>2</sub> .....	31.01	28.85	32.24	34.95	34.40
Al <sub>2</sub> O <sub>3</sub> .....	3.15	4.03	3.66	1.98	1.40	P <sub>2</sub> O <sub>5</sub> .....	.19	.35	.32	None	.16
Fe <sub>2</sub> O <sub>3</sub> .....	4.96	3.67	2.05	3.02	4.49	C.....	.38	.51	.36	.23	.25
FeO.....	51.63	48.63	52.94	56.96	54.03						
H <sub>2</sub> O.....	1.86	2.50	1.90	1.30	1.33		97.69	98.25	98.74	100.10	98.13
TiO <sub>2</sub> .....	.12	.12	.04	.02	.04						

UU, VV. Graphitic schists collected by E. S. Bastin. Determinations by A. A. Chambers, record 3120.

UU. Composite of 80 samples on property of Texas Graphite Co., Burnet. Graphite, 10.64 percent.

VV. Richest rock, same locality. Graphite, 11.74 percent.

WW-YY. Greensands, thought to be an intermediate stage in the origin of iron ore, collected by E. B. Eckel in Cass County. Analyses by J. J. Fahey, record D-375.

WW. Fresh greensand, Surratt tract, 4½ miles north of Linden, on east bank of Bowman Creek.

XX. Oxidized greensand, same locality.

YY. Fresh greensand, west bank of Bowman Creek.

ZZ. Alunite rock or alum from Toyah, Reeves County. Analysis by W. B. Hicks, record 3168.



	WW	XX	YY	ZZ		WW	XX	YY	ZZ
SiO <sub>2</sub> .....	28.67	39.10	27.21	5.79	TiO <sub>2</sub> .....	0.30	0.41	0.42	-----
Al <sub>2</sub> O <sub>3</sub> .....	16.80	23.69	18.87	23.90	CO <sub>2</sub> .....	10.03	.02	9.85	-----
Fe <sub>2</sub> O <sub>3</sub> .....	8.41	20.06	9.32	-----	P <sub>2</sub> O <sub>5</sub> .....	.25	.26	.31	-----
FeO.....	20.74	.58	18.55	-----	MnO.....	.11	.11	.12	-----
MgO.....	1.55	.02	1.49	-----	SO <sub>3</sub> .....	-----	-----	-----	23.70
CaO.....	.45	None	.38	-----	C.....	(1)	(1)	(1)	-----
Na <sub>2</sub> O.....	.03	.10	.11	2.01					
K <sub>2</sub> O.....	.70	.79	.43	4.54					
H <sub>2</sub> O.....	11.76	14.65	13.12	40.06		99.80	99.79	100.18	88.77

<sup>1</sup> Present.

AAA, BBB. Two rocks from Terlingua, associated with mercury ore, collected by C. P. Ross. Analyses by J. J. Fahey, record D-437.

AAA. Fresh argillaceous limestone east of Olivas winze, 50-foot level, Mariposa mine.

BBB. Alteration product of AAA, called "jaboncillo", from portal of tunnel 5, Mariposa mine.

	AAA	BBB		AAA	BBB		AAA	BBB
SiO <sub>2</sub> .....	39.76	63.10	CaO.....	17.49	0.02	CO <sub>2</sub> .....	15.85	None
Al <sub>2</sub> O <sub>3</sub> .....	14.29	20.84	MgO.....	1.30	.02	Hg.....	None	0.08
Fe <sub>2</sub> O <sub>3</sub> .....	1.79	6.30	Na <sub>2</sub> O.....	.42	.36	Cl.....	.05	.17
FeO.....	1.73	.14	K <sub>2</sub> O.....	1.32	1.00			
TiO <sub>2</sub> .....	.60	.63	H <sub>2</sub> O.....	5.46	7.87		100.06	100.53

#### UTAH

A-D. Oxidized silver, lead, and bismuth ores from the Tintic district, collected and described by Lindgren and Loughlin in Prof. Paper 107, 1919. Analyses by R. C. Wells, record 2990.

A. Gemini mine, level 19. Siliceous material covered by fine soft yellow powder.

B. Victoria mine. Contains bismutite.

C, D. Eagle and Blue Ball mine, 1,200-foot level.

	A	B	C	D	E
Ignition.....	4.94	3.57	5.03	2.62	3.55
Insoluble in HNO <sub>3</sub> .....	82.96	66.10	81.83	59.87	82.15
Soluble:					
CO <sub>2</sub> .....	.22	2.48	.71	2.15	.27
Cl.....	None	None	Trace	None	None
As <sub>2</sub> O <sub>3</sub> .....	Trace	.05	1.68	2.16	Trace
P <sub>2</sub> O <sub>5</sub> .....	.41	None	None	None	None
Cu.....	Trace	None	None	Trace	None
Ag.....	.29	4.15	None	1.44	None
PbO.....	.58	.31	3.26	12.25	4.04
Fe <sub>2</sub> O <sub>3</sub> .....	8.24	.92	2.72	1.72	.40
CaO.....	.20	.76	.44	1.26	.22
MgO.....	None	None	None	None	None
Bi <sub>2</sub> O <sub>3</sub> .....	Trace	18.07	2.50	9.07	None?
SO <sub>3</sub> .....	.58	.58	.95?	.41	None
	98.42	96.99	99.12	92.95	90.63

E, F. Uraniferous asphaltite, collected by F. L. Hess from Temple Mountain, San Rafael Swell. Analyses by W. T. Schaller, record C-325.

E. Lower part of †La Plata sandstone, southwest side of "Temple", Temple Rock, 45 miles southwest of Green River.

F. Lower Cowboy claim, Chemical Products Co., south Temple Wash, 42 miles southwest of Green River.



	E	F		E	F
Volatile matter <sup>1</sup> .....	67.11	49.57	S <sup>2</sup> .....	1.37	4.98
Insoluble residue <sup>2</sup> .....	26.54	46.32	As.....	Trace?	Trace?
U.....	2.88	1.13	Se.....	None?	None?
V.....	1.17	.23			

<sup>1</sup> Loss on ignition; includes organic matter, water, and all volatile substances. Not corrected for any change in oxidation of residue.

<sup>2</sup> Residue insoluble in hot HCl. Probably largely sand grains.

<sup>3</sup> Determined by Eschka's method.

G-I. Three samples of alunite from the Marysville district submitted by G. F. Loughlin. Partial analyses by E. P. Henderson, record C-590.

J-N. Five samples from Homer McCarty's prospect, Marysville, collected by B. W. Dyer. Analyses by J. G. Fairchild, record C-1044.

O, P. Samples of alunite collected by G. F. Loughlin at Antelope Canyon, NW  $\frac{1}{4}$  sec. 21, T. 26 S., R. 4 W. Analyses by E. P. Henderson, record C-607. M, N, and O are natroalunite.

	G	H	I	J	K	L	M	N	O	P
SiO <sub>2</sub> .....	38.33	62.20	47.20	-----	-----	-----	5.13	7.86	2.36	4.08
Al <sub>2</sub> O <sub>3</sub> .....	27.96	15.50	26.65	-----	-----	-----	38.17	33.01	27.48	36.57
Fe <sub>2</sub> O <sub>3</sub> .....	-----	-----	-----	-----	-----	-----	1.68	10.37	-----	-----
Na <sub>2</sub> O.....	-----	-----	-----	0.51	1.37	0.41	4.72	3.40	7.43	3.66
K <sub>2</sub> O.....	1.82	.66	.76	2.96	3.71	2.25	2.04	3.29	2.34	5.44
H <sub>2</sub> O.....	-----	-----	-----	-----	-----	-----	14.80	12.21	-----	-----
SO <sub>3</sub> .....	19.45	12.48	14.32	-----	-----	-----	32.37	24.71	38.18	35.41
TiO <sub>2</sub> .....	-----	-----	-----	-----	-----	-----	.35	3.80	-----	-----
	87.56	90.84	89.93	-----	-----	-----	99.26	98.65	85.79	85.16

VIRGINIA

Iron ores collected by J. B. Eby. Analyses by J. G. Fairchild, record C-264.

A. Boons Path Iron Co., Boons Path, 700 feet from foot of slope into mine 8.

B. Boons Path Iron Co., Boons Path, composite sample from three locations in mine 10.

C. Intermont Coal & Iron Co., Irondale, from Old Mule drift, vein 3, 500 feet in.

D. Intermont Coal & Iron Co., Irondale, from South drift, 500 feet in.

E, F. Intermont Coal & Iron Co., Harvey, car sample of ore from operation in vein 3.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	11.30	14.47	18.54	38.01	29.98	31.40
Al <sub>2</sub> O <sub>3</sub> .....	.19	3.18	4.60	4.92	4.80	3.98
Fe <sub>2</sub> O <sub>3</sub> .....	62.79	55.55	60.48	54.06	61.14	60.97
FeO.....	4.23	4.36	5.59	.50	Trace	.42
MgO.....	2.27	2.54	1.03	.13	.21	.20
CaO.....	7.12	8.62	3.48	Trace	.64	.38
SO <sub>3</sub> .....	.08	.08	.09	.02	.06	.03
P <sub>2</sub> O <sub>5</sub> .....	.66	.50	.46	.30	.63	.37

WASHINGTON

Rock partly replaced by manganese ore, Lake Crescent, Olympic district, collected by J. T. Pardee and described in Bull. 795, pp. 6-7, 13, 1928. Partial analyses by J. G. Fairchild, record C-777. A, rock; B, manganese ore.

	A	B		A	B		A	B
MnO.....	8.52	73.88	SiO <sub>2</sub> .....	11.53	7.65	P <sub>2</sub> O <sub>5</sub> .....	0.40	-----
MgO.....	3.03	1.10	Al <sub>2</sub> O <sub>3</sub> .....	6.18	None			
CaO.....	31.70	5.49	Fe <sub>2</sub> O <sub>3</sub> .....	7.95	.94		94.33	93.41
CO <sub>2</sub> .....	24.42	4.35	TiO <sub>2</sub> .....	.60	None	Mn.....	6.60	57.22







LEAD

Sample from Happy Creek, Iditarod district, Alaska, collected by J. B. Mertie, Jr. Analysis by E. T. Erickson, record D-295.

- Main constituent, Pb.
- Also present, Sb.
- Traces, As and Cu.
- Absent, Se, Ge, Ag, Ga, Au, Ni, Co, Zn, Cd, Te, Bi, Sn, and Tl.

PLATINUM

A, B. Specimens of platinum from Oregon, collected by J. T. Pardee. Qualitative spectrographic analysis by George Steiger, record D-134. A, from Esterly mine, Waldo district; B, from Pioneer mine, Coos County.

	A	B
Pt.....	Very large.....	Very large.
Ir.....	Small.....	Fairly large.
Os.....	None.....	None.
Pd.....	Fairly large.....	None.
Rh.....	None.....	Possible trace.
Ru.....	Possible trace.....	Fairly large.

C-F. Samples collected in Alaska by J. B. Mertie, Jr. Analyses by R. C. Wells. C, D, record 3214; E, F, record 3165.

- C. Concentrate from Kodiak Island.
- D. Peters Creek, Susitna Valley.
- E. Boob Creek, Mount Hurst district.
- F. Dime Creek, Koyuk district.

	C	D	E	F		C	D	E	F
SiO <sub>2</sub> , etc.....	1.2	1.0	} 0.6	3.4	Rh.....	0.7	0.5		
IrOs.....	26.9	32.0			Ru.....				0.3
Ir, part from IrOs.....	6.1	9.1			Pd.....	.1	Trace	.3	.9
Rh, part from IrOs.....	.1	.9			Cu.....	.6	.1		Trace
Pt.....	55.3	47.3	83.4	71.5	Ni.....	.08	.03		Trace
Ir.....	2.4	2.2	.4	3.8	Zn+Ag.....	Trace	Trace		.6
Fe.....	6.4	5.2	9.8	6.1					
Pb.....				1.4	Specific gravity.....	100.18	99.83	94.8	98.1
Au.....	.3	1.5		9.5		17.2	18.1		

SULPHUR

A-G collected from three volcanoes on the Alaska Peninsula by A. G. Maddren and described in Bull. 692, pp. 283-398, 1919. Analyses by R. C. Wells, record 3216.

- A-C. High-grade sulphur, Makushin Volcano.
- D-E. Earthy portion, same locality.
- F. Akun Island.
- G. Morainic material from Stepovak Bay.
- H-J. From Jemez Canyon, N. Mex., submitted by G. R. Mansfield. Analyses by B. Salkover, record 3219.

	A	B	C	D	E	F	G	H	I	J
S.....	99.0	88.3	86.3	29.8	13.8	55.5	37.6	38.55	21.17	32.40



## SULPHIDES, ARSENIDES, AND ANTIMONIDES (INCLUDING SULPHO-SALTS)

## ALASKAITE

A, B. Specimen from Colorado, submitted by M. N. Short. Analyses by J. G. Fairchild, record C-1125. A, as analyzed; B, after deducting insoluble and FeS<sub>2</sub>.

	A	B		A	B
Pb.....	12.4	15.4	S.....	19.2	16.0
Bi.....	45.0	55.3	Insoluble.....	7.3	-----
Ag.....	9.5	11.7			
Cu.....	1.3	1.6		100.1	100.0
Fe.....	5.4	None			

## ARSENOPYRITE

Specimen from Jachymov, Bohemia (Czechoslovakia). Analysis by Chase Palmer, record 2911.

Fe.....	34.30
As.....	45.51
S.....	19.75
	99.56

## BORNITE

From Virgilina, Va. Analysis by Chase Palmer, record 3002.

Cu.....	62.50
Fe.....	11.64
S.....	25.15
	99.29

## BRAVOITE

From Spirit Mountain, Alaska, collected by R. M. Overbeck, as an unknown nickel mineral; described in Bull. 712, pp. 94-98, 1920. Analysis by W. T. Schaller, record 3241.

Insoluble in aqua regia.....	1.2	Insoluble in HCl:	
Soluble in HCl:		Cu.....	0.5
Cu.....	.2	Fe.....	18.6
Fe.....	9.8	Ni.....	16.4
Ni.....	3.2	S (by difference).....	50.1

Mn, Zn, Co, As absent.

## CHALMERSITE

From Threemen Mining Co., Landlocked Bay, Prince William Sound, Alaska. Impure; mixed with pyrrhotite and other sulphides. Collected by B. L. Johnson and later described, with a new analysis by E. T. Allen, in Econ. Geology, vol. 12, p. 519, 1917. Preliminary analysis by R. C. Wells, record 2898.

S.....	35.67
Fe.....	46.48
Cu.....	16.57
Pb.....	1.30
Zn.....	.38
	100.40

## ENARGITE

Specimen from Yankee Girl mine, Ouray, Colo. Analysis by Chase Palmer, record 2911.

Cu.....	45.37
Fe.....	1.55
As.....	17.00
S.....	31.14
	95.06

## GALENA

Silver- and bismuth-bearing variety from Leadville, Colo., submitted by E. P. Chapman and described in Econ. Geology, vol. 28, p. 678, 1933. Analysis by R. E. Stevens, record D-159.

Pb.....	63.90	Fe.....	1.21
Ag.....	5.76	Zn.....	.58
Bi.....	11.80	S.....	14.44
Sb.....	1.50		
Cu.....	.23		99.42



## GERSDORFFITE

From Chatham, Middlesex County, Conn., submitted by M. N. Short. Analysis by J. G. Fairchild, record C-1125.

As.....	34.9	Cu.....	None
Ni.....	31.6	S.....	17.1
Co.....	.7	Insoluble.....	None
Fe.....	3.9		
Sb.....	9.1		97.7
Bi?.....	.4		

## GLAUCODOT

From Cobalt, Ontario. Submitted by F. F. Osborne and described in Econ. Geology, vol. 24, p. 728, 1929. Analysis by J. G. Fairchild, record C-1060.

Co.....	20.08	MgO.....	2.35
Ni.....	6.35	CO <sub>2</sub> (calculated).....	6.23
Fe.....	5.82	Insoluble.....	3.84
As.....	36.20		
S.....	15.47		100.99
CaO.....	4.65		

## MAUCHERITE

Three analyses by Chase Palmer, record 2910.

A. Typical maucherite, Thuringia.

B. "Temiskamite", Elk Lake, Cobalt district, Ontario, from T. L. Walker.

C. Supposed chloanthite, Annivierthal, Switzerland.

	A	B	C		A	B	C
Ni.....	48.80	47.69	47.55	As.....	48.50	46.59	47.05
Co.....	1.32	2.03	1.24	Gangue.....	.81	.64	.93
Fe.....	.04	None	1.15				
Bi.....	.27	1.99	2.55		99.79	99.81	99.89
S.....	.05	.87	.42				

## PYRITE

A, B. Two specimens from North Carolina, collected by C. S. Ross. Analysis by George Steiger, record 3206. A, Oliver pyrite mine, 4½ miles south of Crown; B, 1½ miles east of Otto.

	A	B		A	B
Insoluble.....	6.59	4.38	As.....	Trace	Trace
S.....	46.49	33.29	Zn.....	2.30	1.14
Fe.....	39.92	45.67	Pb.....	.30	.26
Cu.....	1.38	.21			

C-I. "Octahedral pyrite" from French Creek iron mines, Pa., collected by Florence Bascom. Thought to be related to an intrusive of Triassic age. Analyses by R. C. Wells, records C-427 and C-431. Other samples showed only traces of cobalt and small percentages of copper. Nickel appeared clearly to be present in D-F, with a little in G, and doubtful traces in C and H.

	C	D	E	F	G	H	I
Co.....	Trace	Trace	( <sup>1</sup> )	( <sup>2</sup> )	Trace	0.03	0.19
Cu.....	0.03	0.10	0.80	1.0	0.10	1.2	15.30
As.....							.04

<sup>1</sup> Very doubtful trace.

<sup>2</sup> Slightly more than a trace.

J. Pyrite, Saul's shaft, 4 miles west of Estabrook, Converse County, Wyo. Analysis by R. C. Wells, record 2958, gave Cu, 0.012 percent.



## PYRRHOTITE

A. From Spirit Mountain, Alaska, collected by R. M. Overbeck and described in Bull. 712, p. 97, 1920. Analysis by W. T. Schaller, record 3241.

B. From Three Cripples mine, near Estabrook, Wyo. Analysis by R. C. Wells, record 2058.

	A	B		A	B
Insoluble in aqua regia.....	0.9	28.38	Insoluble in HCl:		
Soluble in HCl:			Cu.....	0.3	-----
Cu.....	.3	.23	Fe.....	.9	-----
Fe.....	53.2	41.80	Ni.....	None	None
Ni.....	2.2	None	S (by difference).....	42.2	-----
Co.....	None	Trace	Mn, Zn, As.....	None	-----

## SIEGENITE

From La Motte mine of American Lead Co., Madison County, Mo. Analysis by J. G. Fairchild, record C-1070. The sample was considered a mixture of siegenite, chalcopyrite, galena, and insoluble in the proportions of 40, 38, 10, and 12, respectively. Discussed by M. N. Short and E. V. Shannon, Am. Mineralogist, vol. 15, pp. 1-22, 1930.

Pb.....	9.40	S.....	30.57
Cu.....	13.10	Insoluble.....	11.88
Fe.....	15.17		
Co.....	8.72		100.11
Ni.....	11.27		

## SKUTTERUDITE

From Schneeberg, Germany, submitted by M. N. Short. Analysis by J. G. Fairchild, record C-1125.

As.....	75.4	Cu.....	0.7
Ni.....	15.2	S.....	None
Co.....	4.5	Insoluble.....	None
Fe.....	3.5		
Sb.....	None		99.3
Bi?.....	None		

## SMALTITE

A. From Horace Porter mine, Gunnison County, Colo., submitted by M. N. Short. Analysis by J. G. Fairchild, record C-1077.

B. From Schneeberg, Saxony, submitted by M. N. Short. Analysis by J. J. Fahey, record C-1121.

	A	B		A	B
As.....	75.30	63.42	Bi.....	0.86	-----
Co.....	10.98	15.83	Insoluble.....	1.44	.32
Ni.....	5.14	15.07			
Fe.....	5.82	3.69		98.68	99.19

## SPHALERITE

Sample collected by C. S. Ross near Spruce Pine, N. C. Analysis by J. G. Fairchild, record D-390.

Insoluble.....	0.27	Soluble—Continued.	
Soluble:		Pb.....	None
Zn.....	59.34	S.....	34.11
Fe.....	6.16		
Cd.....	.23		100.16
Mn.....	.05		
Cu.....	None	Specific gravity.....	4.070

## TENNANTITE

From Bonanza mine, Colorado, purified by M. N. Short. Analysis by E. P. Henderson, record C-1014, on 0.31 gram.

Sb.....	12.85	Zn.....	5.29
As.....	18.62	Pb.....	Trace
Cu.....	35.49	Ag, not determined, but qualitatively found present.	
Fe.....	5.93		



TETRAHEDRITE

A. From Tintic Standard mine, Utah, submitted by G. F. Loughlin. Analysis by R. C. Wells, record C-595.

B. From Park City district, Utah.

C. From Little Cottonwood district, Utah. B, C, partial analyses by R. C. Wells, record 2901.

	A	B	C		A	B	C
Gangue.....	3.02			Zn.....	3.86		
S.....	24.19			Pb.....	11.41	None	6.24
As.....	4.50	(1)	(1)	Ag.....	.92	Trace	Trace
Sb.....	14.30				98.86		
Cu.....	32.04						
Fe.....	4.62						

<sup>1</sup> Present.

TUNGSTENITE

Collected by J. J. Beeson from Emma mine, Little Cottonwood district, Salt Lake County, Utah. Described by Wells and Butler, Washington Acad. Sci. Jour., vol. 7, p. 596, 1917. WS<sub>2</sub>. Analysis of impure sample by R. C. Wells, record 3188.

W.....	44.7	Pb.....	4.1	H <sub>2</sub> O.....	0.7
S.....	29.1	As.....	1.0	SO <sub>2</sub> .....	.1
Fe.....	8.9	Sb.....	.8	Undetermined.....	7.3
Zn.....	.4	Cu.....	1.3		
Mn.....	.6	Ag.....	.4		100.0
Ni.....	.3	SiO <sub>2</sub> .....	.3		

TELLURIDES

TETRADYMIT

A, B. From Hachita, N. Mex. Analysis by E. P. Henderson on 0.6 gram of selected material, record C-791. A, sample; B, recalculated for mineral.

C. From Whitehorn, Colo. Purified and submitted by M. N. Short. Analysis by E. P. Henderson, record C-922.

	A	B	C		A	B	C
Insoluble in HNO <sub>3</sub> .....	3.66			Fe.....	0.50	0.52	Trace
Te.....	43.66	45.33	46.87	Mg.....	Trace	Trace	Trace
S.....	.69	.71	.29		99.45	99.46	99.93
Se.....	None	Trace	Trace				
Bi.....	50.94	52.90	52.77				

CHLORIDES AND FLUORIDES

CARNALLITE

A. From a depth of 3,150 feet in an oil well 7 miles west of Thompson, Utah. Analysis by R. K. Bailey, record C-549. Identified optically by M. N. Short.

B. From Government well 1, NW<sup>1</sup>/<sub>4</sub> sec. 13, T. 17 S., R. 31 E., Eddy County, N. Mex., depth 933 feet. Analysis by J. J. Fahey, record C-998.

	A	B		A	B
Insoluble.....		0.04	H <sub>2</sub> O.....	39.6	38.38
Mg.....	8.8	8.80	Cl.....	37.7	38.32
Na.....		Trace		100.0	99.61
K.....	13.9	14.07			

CREEDITE

From Wagon Wheel Gap, Colo. Collected by E. S. Larsen and described by Larsen and Wells, Nat. Acad. Sci. Proc., vol. 2, p. 360, 1916. Analysis by R. C. Wells, record 3069. R. E. Stevens found 30.96 percent of fluorine nephelometrically.

H <sub>2</sub> O.....	0.72	O (calculated).....	3.97
H <sub>2</sub> O+.....	11.08	F (calculated).....	30.35
Al.....	11.58		100.00
Ca.....	23.98	Specific gravity.....	2.730
SO <sub>4</sub> .....	18.32		



## GEARKSUTITE

A. From Wagon Wheel Gap, Colo., described by Larsen and Wells, Nat. Acad. Sci. Proc., vol 2, p. 360, 1916. Analysis by R. C. Wells, record 3064. R. E. Stevens found 42.30 percent of fluorine nephelometrically.

B. Between Hot Springs and Warm Springs, Va., about 1 mile north of Hot Springs. Collected and analyzed by E. P. Henderson, record C-1035.

	A	B		A	B
H <sub>2</sub> O-----	0.44	} 15.52	Na-----	0.04	0.20
H <sub>2</sub> O+-----	15.20		K-----	.07	.05
Al-----	15.11	15.06	O-----	5.09	-----
Ca-----	22.41	22.15	F-----	41.00	-----
Mg-----	Trace	-----		99.36	-----
Fe-----	Trace	-----			-----

## HALITE

A-B. From Cardona, Spain, collected by H. S. Gale. Analysis by E. T. Erickson, record 3250. A, Salmon-colored; B, banded.

C. Impure sample collected by O. B. Hopkins, Sinclair Oil & Gas Co.'s Schallert No. 1 well, Duval County, Tex. A composite of 15 samples. Partial analysis by B. Salkover, record 3183.

	A	B	C		A	B	C
Insoluble-----			0.63	Fe-----			0.48
K-----	0.12	0.10	Trace	Cl-----	60.27	58.61	
Na-----	39.00	37.98	30.89	SO <sub>4</sub> -----	.27	1.42	13.77
Ca-----	.08	.54	5.76		99.77	98.67	-----
Mg-----	.03	.02	-----				

H<sub>2</sub>O undetermined.

## KAINITE

From McNutt well no. 1, sec. 4, T. 21 S., R. 30 E., Eddy County, N. Mex. Analysis by J. J. Fahey, record C-1039.

K-----	13.30	H <sub>2</sub> O-----	20.95
Na-----	1.03	Material insoluble in H <sub>2</sub> O-----	1.74
MgO-----	16.72	Fe, Al, and Ca-----	None
Cl-----	13.51		
SO <sub>4</sub> -----	32.50		99.75

## LORETTOITE

From Loretto, Tenn., described by Wells and Larsen, Washington Acad. Sci. Jour., vol. 6, p. 669, 1916. Analysis by R. C. Wells, record 2984.

PbO-----	93.98	CO <sub>2</sub> -----	0.20
Cl-----	3.98	Insoluble in HNO <sub>3</sub> -----	.58
H <sub>2</sub> O-----	.03		
P <sub>2</sub> O <sub>5</sub> -----	.11	Less O-----	100.31
CaO-----	.48		.90
MgO-----	.56		
Al <sub>2</sub> O <sub>3</sub> -----	.08		99.41
ZnO-----	.31		

## "SYLVINITE"

From Amelie mine, near Mulhouse, Alsace. Mixture of halite and sylvite. Average samples as mined and shipped, collected by H. S. Gale. Analyses by E. T. Erickson, record 3249.

	A	B		A	B
Cl-----	50.34	50.13	Mg-----	0.03	0.02
SO <sub>4</sub> -----	2.41	2.10		91.24	92.49
K-----	12.56	17.47	Insoluble in H <sub>2</sub> O-----	8.00	7.02
Na-----	24.71	21.78	Moisture at 180°-----	.33	.30
Ca-----	1.19	.99		99.57	99.81



## SYLVITE

Crude sylvite from Markham salt dome, Texas, submitted by D. C. Barton, December 1924. Sylvite confirmed by M. N. Short, as first proved occurrence in the United States. Analysis by R. K. Bailey, record C-566.

Percent soluble in water.....	97.70
K <sub>2</sub> O in sample.....	15.00
Sulphate.....	Trace

## OXIDES AND HYDROXIDES

## BRAUNITE

Sample collected by D. F. Hewett at Spiller manganese mine, 12 miles north-east of Mason, Mason County, Tex. Analysis by W. T. Schaller, record D-372.

SiO <sub>2</sub> .....	9.90	MgO.....	0.19
MnO.....	66.89	H <sub>2</sub> O.....	.73
Fe <sub>2</sub> O <sub>3</sub> .....	15.39	Insoluble.....	.67
O.....	6.27		
CaO.....	.06		100.10

## CASSITERITE

Wood tin collected by Adolph Knopf in northern Lander County, Nev. Described in U. S. Geol. Survey Bull. 640, pp. 131-135, 1917. Analysis by A. A. Chambers, record 3108.

SnO <sub>2</sub> .....	85.14	H <sub>2</sub> O-.....	0.20
Fe <sub>2</sub> O <sub>3</sub> .....	13.42	H <sub>2</sub> O+.....	.05
SiO <sub>2</sub> .....	1.03		
MnO.....	.02		99.86

## CHROMITE

A-F. Six samples from Cuba, collected by Albert Busch. Analyses by R. C. Wells, record 3229.

- A. 7 miles west of Mocha, Matanzas.
- B. 8 miles southeast of Punta Gorda, Oriente.
- C. 0.75 mile south of Navas Bay, Oriente.
- D. 9 miles northeast of Camaguey, Camaguey.
- E. 3 miles northwest of Alta Gracia, Camaguey.
- F. 2 miles northeast of Alta Gracia, Camaguey.

G. From Deep Creek, 22 miles south of Bend Rock, Wyo. Analysis by George Steiger, record 3222.

	A	B	C	D	E	F	G
Cr <sub>2</sub> O <sub>3</sub> .....	43.0	38.1	27.6	35.7	35.2	34.2	38.82
SiO <sub>2</sub> .....	5.4	.9	8.9	3.9	3.9	1.5	6.45
Fe.....	13.0	11.7	12.9	12.2	12.8	11.1	16.62
Al <sub>2</sub> O <sub>3</sub> .....	15.0	27.0	25.3	29.8	27.4	28.3	12.50
S.....	Trace					None	
P.....	None					Trace	
Ni.....	( <sup>1</sup> )					.05	
MgO.....							15.42
CaO.....							None
MnO.....							.44

<sup>1</sup> Present.

H-M. Six specimens from Kenai Peninsula, Alaska, collected by A. C. Gill and described in Bull. 712, pp. 102-123, 1920. Analyses by Chase Palmer, record C-107.

- H. North shore of Claim Point.
- I. J. Rolf mine, Claim Point.
- K. Ridge northwest of Red Mountain.
- L. Pass between two branches of Fish Creek, Red Mountain.
- M. Ridge between Windy River and north branch of Fish Creek.

	H	I	J	K	L	M
Cr <sub>2</sub> O <sub>3</sub> .....	46.84	34.67	28.62	32.10	48.69	41.93



N-S. Samples from different localities.

N. Deer Creek, Converse County, Wyo. Analysis by Chase Palmer, record 3172.

O. Grant County, Oreg., south side of John Day River, opposite mouth of Cummings Creek. Collected by A. J. Collier. Analysis by R. C. Wells, record 3176.

P. Sent to J. S. Diller by E. T. Wear, of Jolon, Calif. Analysis by R. C. Wells, record 3212.

Q. Deer Creek Canyon, Wyo. Determinations by George Steiger, record 3014.

R. Scotts Bar, Siskiyou County, Calif. Collected by W. D. Johnston, Jr. As analyzed.

S. Same after deducting 2.2 percent  $(Ca,Mg)SiO_3$  assumed to be present. Analysis by Charles Milton, record D-340.

	N	O	P	Q	R	S
SiO <sub>2</sub> .....	7.21				1.29	
Al <sub>2</sub> O <sub>3</sub> .....	33.14				5.84	5.97
Fe <sub>2</sub> O <sub>3</sub> .....					6.40	6.54
FeO.....					14.83	15.16
MgO.....					13.12	12.73
CaO.....					.26	
Cr <sub>2</sub> O <sub>3</sub> .....	44.24	49.6	54.7	35.20	57.92	59.19
V <sub>2</sub> O <sub>5</sub> .....				.56?		
MnO.....					.25	.25
NiO.....					.06	.06
					99.97	99.90

#### CORVUSITE

From Ponto No. 3 claim, Gypsum Valley, San Miguel County, Colo. Collected by F. L. Hess and described in *Am. Mineralogist*, vol. 18, p. 195, 1933. Analyses by W. T. Schaller, record C-734. A, purple black; B, brownish black.

	A	B		A	B
Insoluble SiO <sub>2</sub> .....	0.16	0.17	Fe <sub>2</sub> O <sub>3</sub> .....	1.69	0.99
Soluble SiO <sub>2</sub> .....	.63	2.19	V <sub>2</sub> O <sub>5</sub> .....	10.26	10.13
MoO <sub>3</sub> .....	.16	.18	V <sub>2</sub> O <sub>3</sub> .....	69.00	65.24
CaO.....	1.85	1.70	H <sub>2</sub> O (ignition corrected).....	13.52	14.09
UO <sub>2</sub> .....	1.16	3.12			
Carbonaceous matter.....	.52	1.98		98.95	99.79

#### DELAFOSSITE

From Pope-Shenon mine, Salmon, Idaho, collected by C. P. Ross and described in *Bull.* 774, 1925. Analysis by W. T. Schaller, record C-469.

A. Analysis.

B. Impurities deducted.

C. Theory for Cu<sub>2</sub>O.Fe<sub>2</sub>O<sub>3</sub>.

	A	B	C		A	B	C
Cu <sub>2</sub> O.....	27.94	45.80	47.29	Ignition loss.....	6.62		
Fe <sub>2</sub> O <sub>3</sub> .....	33.06	54.20	52.71				
Insoluble.....	30.94				99.26	100.00	100.00
Soluble SiO <sub>2</sub> .....	.70						

#### GAHNITE

These specimens submitted by C. S. Ross.

A. From McGruger mine, Ga. Analysis by J. J. Fahey, record D-16.

B. From Ore Knob, N. C. Analysis by E. P. Henderson, record C-508.

C. From Ore Knob, N. C. Analysis by J. J. Fahey, record D-25.



	A	B	C		A	B	C
SiO <sub>2</sub> .....	0.50	1.60	0.14	TiO <sub>2</sub> .....	None	0.61	-----
ZnO.....	35.55	38.40	34.47	MnO.....	None	-----	None
Al <sub>2</sub> O <sub>3</sub> .....	54.06	46.55	55.15	MgO.....	3.06	5.84	2.78
FeO <sup>1</sup> .....	7.41	6.69	7.33				
CaO.....	None	-----	None		100.58	99.69	99.87
Cr <sub>2</sub> O <sub>3</sub> .....	None	-----	None				

<sup>1</sup> Total iron as FeO.

## HAUSMANNITE

A-B. From W. T. Gray mine, Batesville district, Ark., collected by H. D. Miser. Analyses by J. G. Fairchild, records 3251 and 3253.

C-E. From Olympic Peninsula, Wash., collected by J. T. Pardee. Analyses by E. P. Henderson, record C-752, 765, and 771. C, magnetic; D and E, non-magnetic.

	A	B	C	D	E
SiO <sub>2</sub> .....		0.10			3.04
MnO.....	91.38	90.40	48.90	84.2	86.40
Excess O.....	7.78	8.87	3.6	8.44	6.47
H <sub>2</sub> O.....	.62	1.03			1.16
(Al,Fe) <sub>2</sub> O <sub>3</sub> .....		.48	11.05	1.08	.76
BaO.....	.26	None			
CaO.....	Trace	Trace			1.28
MgO.....	Trace	Trace			
	100.04	100.88			99.11
Specific gravity at 15.5°.....		4.778			

## HEMATITE

From Tullock Creek coal field, Mont. Collected by G. S. Rogers and described in Prof. Paper 108, pp. 1-10, 1918. Analysis by Chase Palmer, record 3093.

Fe <sub>2</sub> O <sub>3</sub> .....	83.57
S.....	Trace
Cl.....	Trace

## HERCYNITE

Separated from rock from Pittsylvania County, Va., submitted by T. L. Watson and analyzed by George Steiger, record D-262. Association described in Washington Acad. Sci. Jour., vol. 8, pp. 665-670, 1918.

SiO <sub>2</sub> .....	0.84	MgO.....	9.88
Al <sub>2</sub> O <sub>3</sub> .....	53.56	TiO <sub>2</sub> .....	.68
Fe <sub>2</sub> O <sub>3</sub> .....	10.26		
FeO.....	24.78		100.00

## HETAEROLITE

From Leadville, Colo. Analysis by Chase Palmer, record 2973.

ZnO.....	37.66
Mn <sub>2</sub> O <sub>3</sub> .....	54.63
Fe <sub>2</sub> O <sub>3</sub> .....	.67
SiO <sub>2</sub> .....	2.91
H <sub>2</sub> O.....	3.78

99.65

## LEUCOXENE

A hydrous titanium mineral collected in Saline County, Ark., by M. N. Bramlette is provisionally classed as leucoxene. Analysis by Charles Milton, record D-439. Some gibbsite and a little magnetite which could not be removed with the electromagnet were identified under the microscope.

TiO <sub>2</sub> .....	77.24	H <sub>2</sub> O+.....	7.57
Al <sub>2</sub> O <sub>3</sub> .....	6.73	CaO.....	None
Fe <sub>2</sub> O <sub>3</sub> .....	4.83	MgO.....	Trace
P <sub>2</sub> O <sub>5</sub> .....	.93		
SiO <sub>2</sub> .....	.84		100.21
H <sub>2</sub> O.....	2.07		



## LIMONITE

A-B. From North Carolina, collected by W. S. Bayley. Analyses by J. G. Fairchild, record C-376. A, from near Coalville; B, from Linville Mountain, near Avery.

C. From Dragon iron mine, Tintic, Utah, described in Prof. Paper 107, 1919. Analysis by George Steiger, record D-261.

	A	B	C		A	B	C
SiO <sub>2</sub> -----		1.40	3.25	TiO <sub>2</sub> -----		0.05	None
Al <sub>2</sub> O <sub>3</sub> -----		.61	.76	P <sub>2</sub> O <sub>5</sub> -----	Trace	1.95	0.78
Fe <sub>2</sub> O <sub>3</sub> -----	83.35	83.40	80.02	SO <sub>3</sub> -----			.47
FeO-----		None	.24	MnO-----		.12	Trace
MgO-----		None	.30	S-----			.10
CaO-----	None	None	.42	BaO-----		Trace	None
H <sub>2</sub> O-----	.82	.92	1.71				
H <sub>2</sub> O+-----	11.32	11.22	12.30			99.67	100.35

## MAGNETITE

A-D. Four samples from North Carolina, collected by W. S. Bayley. Analyses by J. G. Fairchild, record 3258.

A. Cranberry mine, Cranberry.

B. Peg Leg mine on Doe River, 1 mile south of Roan Mountain station.

C. Lansing mine, Ashe County.

D. Lansing mine, Helton Creek.

E. Magnetic iron ore from Conejos quadrangle, Colo., collected by E. S. Larsen. Analysis by J. G. Fairchild, record C-241.

	A	B	C	D	E		A	B	C	D	E
SiO <sub>2</sub> -----	14.28	4.67	5.73	2.33	3.54	H <sub>2</sub> O+-----	0.17	0.38	2.81	0.83	0.33
Al <sub>2</sub> O <sub>3</sub> -----	1.08	.58	1.70	2.38	1.45	TiO <sub>2</sub> -----	.12	.80	12.96	Trace	.50
Fe <sub>2</sub> O <sub>3</sub> -----	50.35	62.90	45.51	60.42	65.15	CO <sub>2</sub> -----	None	None	None	1.97	None
FeO-----	28.30	28.90	26.20	24.80	27.61	P <sub>2</sub> O <sub>5</sub> -----	None	Trace	Trace	Trace	Trace
MgO-----	.62	.33	3.99	3.37	.24	SO <sub>3</sub> -----	Trace	.23	Trace	.11	.20
CaO-----	5.18	1.04	Trace	1.14	.22	MnO-----	.18	.16	.34	3.01	.37
Na <sub>2</sub> O-----	.37	.22	Trace	.26	Trace	Cr <sub>2</sub> O <sub>3</sub> -----	None	None	.39	None	-----
K <sub>2</sub> O-----	Trace	Trace	Trace	Trace	Trace						
H <sub>2</sub> O-----	.04	.06	.06	.04	.13						
							100.69	100.27	99.69	100.66	99.74

## PSILOMELANE

From Tucson, Ariz., collected by D. F. Hewett. Analysis by Charles Milton, record D-208.

Insoluble-----	8.35	K <sub>2</sub> O-----	0.11	CuO-----	0.25
SiO <sub>2</sub> (soluble)-----	.90	H <sub>2</sub> O-----	.49	PbO-----	.32
Al <sub>2</sub> O <sub>3</sub> -----	.55	H <sub>2</sub> O+-----	3.78	MnO <sub>2</sub> -----	59.65
Fe <sub>2</sub> O <sub>3</sub> -----	3.27	TiO <sub>2</sub> -----	Trace		
MgO-----	Trace	P <sub>2</sub> O <sub>5</sub> -----	.05		99.29
CaO-----	.05	MnO-----	6.70		
Na <sub>2</sub> O-----	.42	BaO-----	14.40	Specific gravity-----	4.21

## PYROLUSITE

A. Sample containing cobalt and nickel collected from a prospect near Coble, Hickman County, Tenn. Analysis by E. P. Henderson, record C-631.

B. Composite of 50 samples from Caddo Gap and DeQueen quadrangles, Ark., described by Miser and Purdue in Bull. 808, 1929. Analysis by George Steiger, record 3141.

C. From Puerto Rico. Analysis by George Steiger, record 3143.

	A	B	C		A	B	C
Insoluble-----	6.05	5.17	0.66	Cu-----	Trace		
MnO <sub>2</sub> -----	52.93	64.60	73.9	Li-----	Trace		
Al <sub>2</sub> O <sub>3</sub> -----	21.15	4.80		F-----	None		
Fe <sub>2</sub> O <sub>3</sub> -----	.88	9.62	.77	CaO-----	None	1.42	0.17
CoO-----	.81			SO <sub>3</sub> -----	None	.05	.08
NiO-----	1.48			CO <sub>2</sub> -----	None		
BaO-----	.11					98.01	
H <sub>2</sub> O-----	14.40						
P <sub>2</sub> O <sub>5</sub> -----	.20	.81	.11				



SPINEL

Associated with serendibite, Warren County, N. Y., collected by E. S. Larsen. Partial analysis by W. T. Schaller, record C-733.

Insoluble.....	0.86	CaO.....	0.29
SiO <sub>2</sub> .....	4.23	MgO.....	24.24
Al <sub>2</sub> O <sub>3</sub> .....	60.63		
FeO.....	4.57		94.82

TENORITE

Impure material from Tintic district, Utah. Analysis by W. T. Schaller, record 3074.

CuO.....	80.12
H <sub>2</sub> O.....	4.02
P <sub>2</sub> O <sub>5</sub> .....	1.44
Insoluble.....	2.94
X(?).....	11.48

100.00

VANOXITE

From Jo Dandy claim, Paradox Valley, 58 miles west of Placerville, Colo. Submitted by A. O. Egbert. Described by F. L. Hess in Bull. 750, pp. 63-67, 1925. Analyses by W. T. Schaller, record C-314-a.

- A. As received.
- B. With impurities, quartz, gypsum, carnotite, ferganite, uvanite, pyrite, roscoelite, deducted.
- C. Different sample as received.
- D. With impurities deducted.

	A	B	C	D		A	B	C	D
V <sub>2</sub> O <sub>4</sub> .....	11.93	51.60	22.56	49.66	MoO <sub>3</sub> .....	0.11	-----	-----	-----
V <sub>2</sub> O <sub>5</sub> .....	6.25	27.03	13.59	29.91	SO <sub>2</sub> .....	6.26	-----	0.24	-----
UO <sub>2</sub> .....	1.55	-----	-----	-----	Insoluble.....	61.51	-----	51.35	-----
P <sub>2</sub> O <sub>5</sub> .....	.11	-----	[2.58]	-----	Soluble silica.....	.19	-----	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	.94	-----	-----	-----	Se.....	Trace	-----	Trace	-----
H <sub>2</sub> O.....	} [7.37]	21.37	{ 3.13	6.89					
H <sub>2</sub> O+.....					{ 6.15	13.54			
CaO.....	3.78	-----	.40	-----		100.00	100.00	100.00	100.00

WAD

From Suiter, Va., collected by H. D. Miser. Analysis by J. G. Fairchild, record C-240.

MnO.....	67.10
Available O.....	13.41
H <sub>2</sub> O.....	1.04
H <sub>2</sub> O+.....	7.60
BaO.....	(1)

<sup>1</sup> Present.

89.15

CARBONATES

ANKERITE

A. From North Star mine, Grass Valley, Calif., collected by W. D. Johnston, Jr. Analysis by J. G. Fairchild, record D-115.

B. From Latouche Island, Alaska. Partial analysis by Chase Palmer, with carbon dioxide calculated, record 3174.

C. From Fontana copper deposit, N. C., collected by C. S. Ross. Analysis by E. P. Henderson, record C-701.

	A	B	C		A	B	C
Insoluble.....	1.46	-----	1.10	CO <sub>2</sub> .....	43.30	43.02	44.19
CaO.....	30.64	30.52	27.26	H <sub>2</sub> O.....	.40	-----	-----
MgO.....	11.38	10.93	12.99	Fe <sub>2</sub> O <sub>3</sub> .....	.32	-----	-----
FeO.....	12.52	10.22	12.78				
MnO.....	.31	1.32	1.28		100.33	96.01	99.60



## CALCITE

[A few analyses of calcite are also given under "Ores and gangue materials".]

A-G. Seven samples collected by C. S. Ross. Analyses A-E by E. P. Henderson, record C-701; F-G by J. G. Fairchild, record C-731.

A. From Ducktown, Tenn., 1,200 level, Burra Burra mine, coarse rhombs associated with ore.

B. Burra Burra dump.

C. From vein cutting hornblende-epidote rock, Cranberry, N. C.

D. Associated with ore, Cullowhee, N. C.

E. From quartz vein at 1,400-foot level, Burra Burra mine.

F. Associated with ore and barite, Peach Bottom mine, N. C.

G. Associated with gold-bearing quartz veins, Columbia gold mine, near Thompson, Ga.

	A	B	C	D	E	F	G
Insoluble in HCl.....	0.20	0.80	0.10	0.20	None	8.98	5.62
FeO.....	1.76	1.14	.88	.77	1.73	1.36	None
MnO.....	Trace	.19	.37	Trace	1.38	.55	.17
CaO.....	53.40	54.14	55.46	55.78	53.20	49.22	52.80
MgO.....	Trace	.15	.20	.46	.45	.42	Trace?
BaO.....					(?)	.24	(?)

<sup>1</sup> From total Fe.

<sup>2</sup> Undetermined.

H-K. Manganiferous calcite. H, I, collected by C. S. Ross; analyses by J. J. Fahy, record C-1054. J, K, collected by D. F. Hewett; determinations by J. G. Fairchild, record C-1021.

H. Near Sparta, N. C.

I. Kings Mountain, N. C.

J. Water Canyon, Socorro County, N. Mex. Vein calcite.

K. Aguila, Maricopa County, Ariz. Vein calcite.

	H	I	J	K		H	I	J	K
Insoluble.....	0.25	2.48			BaO.....			3.46	0.13
FeO.....	.05	.04			CuO.....			.13	None
MgO.....	.82	.64			ZnO.....			.02	None
CaO.....	31.54	53.38			PbO.....			None	None
CO <sub>2</sub> (calculated)....	41.92	43.11							
MnO.....	26.02	.67	91.89	1.14		100.60	100.32		

L. "Biaxial calcite" from Ore Knob, N. C., associated with pyrrhotite and copper minerals. Collected by C. S. Ross. Analysis by J. H. Fairchild, record C-494.

CaO.....	48.68	Fe <sub>2</sub> O <sub>3</sub> <sup>1</sup> .....	3.42
MgO.....	1.23	CO <sub>2</sub> (calculated).....	42.31
MnO.....	4.32	Insoluble.....	.85
SrO.....	.17		
BaO.....	None		99.98
PbO.....	None		

<sup>1</sup> Calculated from total Fe. May include traces of Al<sub>2</sub>O<sub>3</sub>.

M. Pisolite deposited from hot springs at the terraces, San Antonio, Tex. Specimen submitted by Alexander Deussen. Analysis by W. C. Wheeler, record 3049.

SiO <sub>2</sub> .....	1.88	CaO.....	52.89
Al <sub>2</sub> O <sub>3</sub> .....	.36	Ignition.....	43.73
Fe <sub>2</sub> O <sub>3</sub> .....	.27		
MgO.....	.76		99.89

## CERUSITE

From the Colorado mine, Tintic, Utah. Collected by Waldemar Lindgren. Analysis by R. C. Wells, record 2988.

Insoluble in HNO <sub>3</sub> .....	8.39	SO <sub>3</sub> .....	1.19
Cl.....	.02	Ca, Mg.....	None
CO <sub>2</sub> .....	14.43		
PbO.....	72.85		97.46
Fe <sub>2</sub> O <sub>3</sub> .....	.58		



HYDROMAGNESITE

From Paradise Range, Nye County, Nev., collected by Eugene Callaghan and described in Nevada Univ. Bull., vol. 27, no. 1, pp. 7-34, 1933. Analysis by Charles Milton, record D-267.

MgO.....	42.82	Fe <sub>2</sub> O <sub>3</sub> .....	0.09
CO <sub>2</sub> .....	37.36	Insoluble.....	.07
CaO.....	.04		
H <sub>2</sub> O.....	.06		99.70
H <sub>2</sub> O+.....	19.26		

HYDROZINCITE

From Goodsprings, Nev., collected by D. F. Hewett and described in Prof. Paper 162, 1931. Analysis by W. T. Schaller, record C-1056.

ZnO.....	72.81	Soluble SiO <sub>2</sub> .....	0.10
CO <sub>2</sub> .....	17.10	Insoluble.....	.18
H <sub>2</sub> O.....	.15		
H <sub>2</sub> O+.....	8.86		99.60
CaO.....	.40		

MAGNESITE

[See also under "Carbonate rocks".]

A. From Magnesite Wash, Nev., collected by W. W. Rubey. Analysis by R. C. Wells, record D-312.

B. Submitted by R. S. Talbot, of Spokane, Wash. Analysis by W. B. Hicks, record 3118.

C. From Red Mountain, Livermore, Calif. Analysis by R. C. Wells, record 2963.

D-E. Two samples representing face cuttings near Kaolin, Clark County, Nev., collected by H. S. Gale. Partial analyses by W. B. Hicks, record 3063.

F. From Porterville, Calif. U. S. National Museum No. 77516. Analysis by Charles Milton, record D-256.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	11.27	2.66	0.03	11.12	11.82	0.09
Al <sub>2</sub> O <sub>3</sub> .....	1.62	.86	.07	.98	.94	-----
Fe <sub>2</sub> O <sub>3</sub> .....						
FeO.....	.31					
CaO.....	6.59	.34	.85	5.36	5.90	.03
MgO.....	35.98	45.80	46.70	36.72	36.40	47.63
MnO.....	Trace					
K <sub>2</sub> O.....	.63					
Na <sub>2</sub> O.....	.72					
TiO <sub>2</sub> .....	.06					
CO <sub>2</sub> .....	38.80	50.04	51.94	44.15	43.45	52.17
H <sub>2</sub> O.....	1.90	.29				
H <sub>2</sub> O+.....	2.17					
B <sub>2</sub> O <sub>3</sub> .....						.07
SO <sub>2</sub> .....	.21					
	100.26	99.70	90.88	98.33	98.51	99.99

RHODOCHROSITE

Two samples collected by Arthur Keith from Sevier, Tenn. Partial analyses by George Steiger, record 3227.

	A	B		A	B
SiO <sub>2</sub> .....	15.54	9.53	MgO.....	3.00	11.63
Al <sub>2</sub> O <sub>3</sub> .....	2.42	4.02	CaO.....	11.58	22.10
Fe <sub>2</sub> O <sub>3</sub> .....	1.50	2.28	MnO.....	33.98	11.98

SIDERITE

[See also analyses under "Ores and gangue materials".]

A. From locality 5 miles south of Linden, Tex., collected by E. F. Burchard. Analysis by R. C. Wells, record 2997.

B. From Bigorre, France, with a little quartz. U. S. National Museum No. 16874. Analysis by R. C. Wells, record D-104. Some magnetite was identified in the sample, and the calculated CO<sub>2</sub> takes account of this, requiring 0.76 percent FeO.

C. From Isère, France. Analysis by J. G. Fairchild, record D-94.



	A	B	C		A	B	C
Insoluble.....	-----	3.90	None	H <sub>2</sub> O+.....	1.05	-----	-----
SiO <sub>2</sub> .....	1.10	-----	-----	TiO <sub>2</sub> .....	.04	-----	-----
Al <sub>2</sub> O <sub>3</sub> .....	1.02	-----	-----	CO <sub>2</sub> .....	36.54	<sup>1</sup> 36.80	<sup>1</sup> 41.00
Fe <sub>2</sub> O <sub>3</sub> .....	.40	1.70	0.60	P <sub>2</sub> O <sub>5</sub> .....	.11	-----	-----
FeO.....	59.42	53.60	47.86	S.....	.05	-----	-----
MgO.....	-----	3.70	10.40	MnO.....	.13	-----	.10
CaO.....	.16	.50	.40				
H <sub>2</sub> O.....	.15	-----	-----				
					100.17	100.20	100.35

<sup>1</sup> Calculated.

## STRONTIANITE

Collected by Adolph Knopf from Barstow, Calif., and described in Bull. 660, pp. 257-264, 1918. Analyses by R. C. Wells, records 3177 and 3179.

	A	B		A	B
SiO <sub>2</sub> .....	-----	5.59	CO <sub>2</sub> .....	-----	28.18
Al <sub>2</sub> O <sub>3</sub> .....	-----	1.17	SO <sub>3</sub> .....	0.03	.28
Fe <sub>2</sub> O <sub>3</sub> .....	-----	1.73	TiO <sub>2</sub> .....	-----	.05
CaO.....	6.40	5.19			
SrO.....	60.99	55.20			96.39
BaO.....	None	None			

<sup>1</sup> Total Fe.

## SILICATES

## ALBITE

Two partial analyses of specimens from Batchellerville, N. Y., by George Steiger, record 3167.

	A	B
Na <sub>2</sub> O.....	9.73	9.27
K <sub>2</sub> O.....	.90	1.19

## ALLANITE

From locality 14 miles northwest of Wheatland, Wyo. Described in Am. Mineralogist, vol. 19, pp. 81-82, 1934. Analysis by R. C. Wells, record C-1080. Calculated age, 1,500 million years.

SiO <sub>2</sub> .....	33.64	MnO.....	0.25	PbO.....	0.11
ThO <sub>2</sub> .....	1.28	CaO.....	9.75	BeO.....	<sup>1</sup> None
Al <sub>2</sub> O <sub>3</sub> .....	12.16	MgO.....	1.83		
Fe <sub>2</sub> O <sub>3</sub> .....	7.67	H <sub>2</sub> O.....	2.84		100.22
Ce <sub>2</sub> O <sub>3</sub> .....	14.63	TiO <sub>2</sub> .....	.24		
(La,Di) <sub>2</sub> O <sub>3</sub> .....	7.34	U <sub>2</sub> O <sub>8</sub> .....	.02	Specific gravity.....	3.72
FeO.....	8.46				

<sup>1</sup> Test by J. J. Fahey.

## ALLOPHANE

Six samples submitted by C. S. Ross. For optical and dehydration data on allophane see Prof. Paper 185-G, pp. 144-148, 1934, by Ross and Kerr.

A. From Laurium, Greece.

B. From Monte Vecchio, Sardinia.

C. From Dutchess County, N. Y.

D. From Morehead, Ky. Analyses A-D by J. J. Fahey, record D-200.

E. From Huron, Lawrence County, Ind. Analysis by J. G. Fairchild, record D-155.

F. From Liege, Belgium. Analysis by L. T. Richardson, record D-67.



	A	B	C	D	E	F
SiO <sub>2</sub> .....	28.60	32.30	25.19	27.61	21.26	33.96
Al <sub>2</sub> O <sub>3</sub> .....	31.66	30.41	36.53	32.29	34.95	31.12
Fe <sub>2</sub> O <sub>3</sub> .....	.16	.23	.78	.23	.10	None
P <sub>2</sub> O <sub>5</sub> .....	None	.02	.02	1.31	7.15	-----
H <sub>2</sub> O.....	19.26	16.38	21.20	19.36	14.85	12.84
H <sub>2</sub> O+.....	14.64	14.43	15.76	18.05	21.38	20.28
CuO.....	.96	1.60	-----	-----	-----	-----
ZnO.....	2.62	4.06	-----	-----	-----	-----
MgO.....	.12	.29	.02	.10	.05	-----
CaO.....	.20	.02	.04	.02	None	2.26
CO <sub>2</sub> .....	1.20	.55	1.04	.72	-----	-----
SO <sub>3</sub> .....	.04	.21	None	.12	-----	-----
TiO <sub>2</sub> .....	None	None	None	None	-----	-----
Organic matter.....	-----	-----	-----	-----	Trace	-----
Na <sub>2</sub> O.....	.28	.10	.10	.10	-----	-----
K <sub>2</sub> O.....						
	99.74	100.60	100.68	99.91	99.74	100.46

## ANALCITE

A-B. Collected by W. H. Bradley from a bed 750 feet above the base of the Green River formation in sec. 27, T. 9 S., R. 25 E., Uintah County, Utah, and described in Prof. Paper 158, pp. 1-7, 1930.

A. Determinations on material of specific gravity below 2.47 separated by heavy solution by E. P. Henderson, record C-920.

B. Except for pyrite, bituminous material, and calcite, almost pure analcite. Analysis by J. G. Fairchild, record C-986. H<sub>2</sub>O+ was determined on material extracted with C<sub>6</sub>H<sub>6</sub>.

C. From Aquarius Cliffs, Yavapai County, Ariz. Submitted by C. S. Ross. Analysis by J. G. Fairchild, record C-979.

D. Crystals coating a brecciated porphyritic rock at Terlingua, Tex., collected by C. P. Ross. Analysis by Charles Milton, record D-399.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	55.07	52.54	60.61	57.86	CO <sub>2</sub> .....	-----	0.29	-----	-----
Al <sub>2</sub> O <sub>3</sub> .....	25.07	15.78	18.03	21.03	FeS <sub>2</sub> .....	-----	2.74	-----	-----
Fe <sub>2</sub> O <sub>3</sub> .....	-----	4.54	1.01	-----	Bituminous material.....	-----	3.93	-----	-----
MgO.....	-----	.63	.05	Trace					
CaO.....	-----	.36	.04	-----					
Na <sub>2</sub> O.....	-----	8.63	10.98	12.51					
K <sub>2</sub> O.....	-----	1.16	1.02	None					
H <sub>2</sub> O.....	-----	.05	.34	} 8.28					
H <sub>2</sub> O+.....	-----	8.96	8.36						
						99.61	100.44		99.68

## ANAUXITE

Two samples submitted by C. S. Ross and described in Prof. Paper 165, pp. 161-169, 1931. Analyses by J. G. Fairchild, record C-993.

A. Anauxite 1 mile west of Lancha Plana, Calif., near the Mokelumne River.

B. From Newman pit near Ione, Calif., Mokelumne River.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	52.46	48.80	CaO.....	0.03	0.22	H <sub>2</sub> O+.....	12.07	12.81
Al <sub>2</sub> O <sub>3</sub> .....	32.20	35.18	Na <sub>2</sub> O.....	.25	.25	TiO <sub>2</sub> .....	.55	.61
Fe <sub>2</sub> O <sub>3</sub> .....	1.69	1.24	K <sub>2</sub> O.....	.31	.40			
MgO.....	None	None	H <sub>2</sub> O.....	1.38	1.16		100.94	100.67

## ANTIGORITE

From Verdolite quarry, near Easton, Pa., collected by W. S. Bayley. Analysis by J. G. Fairchild, record C-527.

SiO <sub>2</sub> .....	46.20	Na <sub>2</sub> O.....	0.25	F.....	0.60
Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> .....	5.59	K <sub>2</sub> O.....	4.54	CO <sub>2</sub> .....	Present
FeO.....	1.06	H <sub>2</sub> O.....	.24		
MgO.....	33.95	H <sub>2</sub> O+.....	5.72		98.15
CaO.....	None				



## BAVENITE

From Himalaya mine, Mesa Grande, San Diego County, Calif. Analysis by J. G. Fairchild, record D-66. This specimen was received by W. T. Schaller from E. Schernikow.

SiO <sub>2</sub> .....	58.40	BeO.....	2.67
Al <sub>2</sub> O <sub>3</sub> .....	12.16	H <sub>2</sub> O.....	2.90
Fe <sub>2</sub> O <sub>3</sub> .....	.10		
CaO.....	23.67		99.96

## BEIDELLITE

A-B. Two samples from Tremont, Miss., submitted by C. S. Ross. Analysis by J. J. Fahey, record C-1118. A, powder; B, lump.

C, D. Beidellite from Princessa mine, Maniquipi, Chihuahua, Mexico, submitted by C. S. Ross. Analysis by E. T. Erickson, record D-432.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	57.96	54.70	43.76	49.34	Na <sub>2</sub> O.....	None	None	0.20	-----
Al <sub>2</sub> O <sub>3</sub> .....	27.61	28.53	27.88	22.88	H <sub>2</sub> O.....	1.41	3.16	10.59	14.77
Fe <sub>2</sub> O <sub>3</sub> .....			6.42	2.36	H <sub>2</sub> O+.....	9.31	8.94	7.67	6.57
FeO.....	1.40	1.63	Trace	Trace	TiO <sub>2</sub> .....			.30	None
MgO.....	1.25	.98	1.23	1.67	C.....	1.18	2.41		
CaO.....	None	None	.90	2.66					
K <sub>2</sub> O.....	.70	.58	1.18	-----		100.82	100.93	100.23	100.25

E-H. Samples submitted by C. S. Ross. Analyses E, F, by J. G. Fairchild, record C-993; G, H by L. T. Richardson, record D-67; E, Ancon, Panama; F, Fairview, Utah; G, H, Cornwall, England.

I. From a tunnel near Twin Falls, Idaho. Analysis by J. J. Fahey, record D-124.

J. Beidellite gouge from Flathead mine, Montana, collected by P. J. Shenon. Analysis by J. G. Fairchild, record D-92.

	E	F	G	H	I	J
SiO <sub>2</sub> .....	44.02	46.04	46.66	45.13	49.55	43.83
Al <sub>2</sub> O <sub>3</sub> .....	28.90	22.60	37.81	35.25	17.78	26.82
Fe <sub>2</sub> O <sub>3</sub> .....	5.15	5.48	.60	2.19	6.61	7.56
FeO.....	.337	.25				Trace
MgO.....	.50	1.85	.26	.46	3.24	.61
CaO.....	.68	1.26		.42	None	.10
Na <sub>2</sub> O.....	.17	Trace				
K <sub>2</sub> O.....	.50	2.25	.19	.52		.33
H <sub>2</sub> O.....		10.00	.70	3.86	15.45	8.64
H <sub>2</sub> O+.....	18.64	9.86	13.92	12.24	6.88	11.08
TiO <sub>2</sub> .....	.53	.40			.58	.42
BaO.....						.29
	99.42	99.99	100.14	100.07	100.09	99.68

## BEMENTITE

Samples collected from Black and White mine, Olympic Mountains, Wash., by J. T. Pardee. Analyses by George Steiger, records 3225 and 3261.

A. Bementite rock, described by Pardee in Bull. 725, pp. 234-236, 1922.

B. Bementite separated from same, described by Pardee, Larsen, and Steiger in Washington Acad. Sci. Jour., vol. 11, p. 25, 1921.

	A	B		A	B
SiO <sub>2</sub> .....	26.38	39.92	FeO.....		4.15
Al <sub>2</sub> O <sub>3</sub> .....	3.48	1.32	H <sub>2</sub> O.....	} 18.32	.49
Fe <sub>2</sub> O <sub>3</sub> .....	3.52		H <sub>2</sub> O+.....		7.90
CaO.....	1.56	.40			
MgO.....	1.31	4.46		98.44	100.22
MnO.....	46.57	41.58			



## BERYL

Slightly altered material from Custer County, S. Dak., received through F. W. Horton, of the U. S. Bureau of Mines. Analysis by R. E. Stevens, record D-334. Probably from the Old Mike mine.

SiO <sub>2</sub> .....	63.32	Li <sub>2</sub> O.....	0.95	MgO.....	0.13
Fe <sub>2</sub> O <sub>3</sub> .....	.04	K <sub>2</sub> O.....	.23	P <sub>2</sub> O <sub>5</sub> .....	.04
BeO.....	9.75	Rb <sub>2</sub> O.....	.09	H <sub>2</sub> O.....	2.36
Al <sub>2</sub> O <sub>3</sub> .....	20.00	CaO.....	1.38		
Na <sub>2</sub> O.....	1.70		None		99.99

## BIOTITE

From locality 8 miles northwest of Custer, S. Dak., on property of Maywood Chemical Co., submitted by F. L. Hess. Analysis by J. J. Fahey, R. C. Wells, and R. E. Stevens, record D-40. Described in Am. Mineralogist, vol. 17, p. 173, 1932, but analysis revised in 1934.

SiO <sub>2</sub> .....	36.97	H <sub>2</sub> O+.....	2.48	F.....	3.17
Fe <sub>2</sub> O <sub>3</sub> .....	2.26	MnO.....	.22		
Al <sub>2</sub> O <sub>3</sub> .....	17.51	Cr <sub>2</sub> O <sub>3</sub> .....	None		101.03
TiO <sub>2</sub> .....	2.64	Na <sub>2</sub> O.....	.45	Less O=F <sub>2</sub> .....	1.34
FeO.....	14.81	Li <sub>2</sub> O.....	.65		
CaO.....	None	K <sub>2</sub> O.....	8.50		99.69
MgO.....	8.45	Rb <sub>2</sub> O.....	1.46		
H <sub>2</sub> O-.....	.32	Cs <sub>2</sub> O.....	1.14	Specific gravity.....	3.10

## BISBEETE

A. From Shattuck mine, Bisbee, Ariz., U. S. National Museum Canfield collection no. 6593.

B. Another specimen, U. S. National Museum no. R. 4874.

C. Recalculated from B, deducting 9.25 percent of malachite. Analysis A-C, by W. T. Schaller, record D-21.

D. An earlier analysis of bisbeete by W. T. Schaller, record 2926.

	A	B	C	D		A	B	C	D
SiO <sub>2</sub> .....	36.71	33.33	36.93	36.0	H <sub>2</sub> O+.....	7 8.32	7.48	7.46	5.4
Fe <sub>2</sub> O <sub>3</sub> .....	1.31	.51			CO <sub>2</sub> .....		1.84		
FeO.....				.9					
CaO.....	.48	.35	.39			100.64	100.02	100.00	99.3
CuO.....	49.45	48.78	46.66	52.1	Specific gravity.....	3.05	2.98	2.88	
H <sub>2</sub> O-.....	1 4.37	7.73	8.56	4.9					

<sup>1</sup> Average of 4.34 and 4.40.

<sup>2</sup> Average of 8.25 and 8.38.

<sup>3</sup> Determined by J. G. Fairchild.

## CERITE

From locality 2 miles N. 45° E. of Jamestown, Boulder County, Colo., Fidelity Lode claim, east central part of sec. 17, T. 2 N., R. 71 W., submitted by E. N. Goddard and T. S. Lovering. Analysis by J. G. Fairchild, record D-405. Part of fluorite removed by grinding and sieving. Specific gravity, 4.653. Pb/U+0.38 Th=0.130. Age calculated, 920 million years.

SiO <sub>2</sub> .....	18.78	MnO.....	0.17	F.....	5.94
Al <sub>2</sub> O <sub>3</sub> , TiO <sub>2</sub> .....	.24	ZnO.....	None	Cl.....	None
FeO.....	1.17	CaO.....	12.55	B <sub>2</sub> O <sub>3</sub> , BeO.....	None
U <sub>2</sub> O <sub>5</sub> (U=0.435).....	.513	MgO.....	.16		
Ce <sub>2</sub> O <sub>3</sub> .....	28.85	PbO (Pb=0.069).....	.074	Less O=F <sub>2</sub> .....	100.827
(La, Tb) <sub>2</sub> O <sub>3</sub> , etc.....	27.20	H <sub>2</sub> O.....	.96		2.52
Y <sub>2</sub> O <sub>3</sub> , etc.....	2.94	CO <sub>2</sub> .....	1.00		
ThO <sub>2</sub> (Th=0.25).....	.28	P <sub>2</sub> O <sub>5</sub> .....	None		98.307

## CHRYSOCOLLA

A. From Live Oak mine, Miami district, Ariz., collected by F. L. Ransome.

B. From Keystone Copper mine, 5 miles west of Globe, Ariz., collected by D. B. Sterrett. Analyses A, B by W. T. Schaller, record C-317.

C. From Emerald Isle mine, Kingman, Ariz., submitted by W. T. Schaller. Analysis by L. T. Richardson, record D-76.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	44.12	41.44	40.30	MgO.....	0.40	0.31	0.40
CuO.....	31.70	34.25	28.90	H <sub>2</sub> O-.....			16.92
FeO.....	.68	.30		H <sub>2</sub> O+.....			8.38
CaO.....	1.02	.79	1.05				
					97.92	97.09	99.38



## CLINOHYPERSTHENE

From Roseland, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-196.

SiO <sub>2</sub> .....	52.02	CaO.....	1.90	MnO.....	0.16
Al <sub>2</sub> O <sub>3</sub> .....	2.64	H <sub>2</sub> O.....	.06		
Fe <sub>2</sub> O <sub>3</sub> .....	.55	H <sub>2</sub> O+.....	.34		101.17
FeO.....	21.46	TiO <sub>2</sub> .....	.44		
MgO.....	21.60			Specific gravity.....	3.496

## CLINOPTILOLITE

From Dome, Ariz. Separated from bentonite by washing and removal of feldspar and quartz by M. N. Bramlette, and described by Bramlette and Posnjak in Am. Mineralogist, vol. 18, p. 167, 1933. Analysis by J. G. Fairchild, record D-198.

SiO <sub>2</sub> .....	64.30	K <sub>2</sub> O.....	1.36
Al <sub>2</sub> O <sub>3</sub> .....	12.78	H <sub>2</sub> O.....	4.78
Fe <sub>2</sub> O <sub>3</sub> .....	.82	H <sub>2</sub> O+.....	9.50
MgO.....	.62		
CaO.....	2.42		100.54
Na <sub>2</sub> O.....	3.96		

## CLINOZOISITE

From Roseland, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-196.

SiO <sub>2</sub> .....	39.96	CaO.....	23.58	MnO.....	Trace
Al <sub>2</sub> O <sub>3</sub> .....	30.59	(K, Na) <sub>2</sub> O.....	.13		
Fe <sub>2</sub> O <sub>3</sub> .....	3.23	H <sub>2</sub> O.....	None		100.19
FeO.....	.60	H <sub>2</sub> O+.....	2.00		
MgO.....	.05	TiO <sub>2</sub> .....	.05		

## DICKITE

A. Sample from Cusiuhiriachic, Chihuahua, Mexico, described by C. S. Ross in Prof. Paper 165, pp. 158-161, 1931. Analysis by J. G. Fairchild, record C-993.

B. Dickite from vertical seams on Back Bone Mountain, about 2 miles north of Williams, Le Flore County, Okla. Analysis by R. K. Bailey, record 3042. Described as "intumescent kaolinite" by Schaller and Bailey, Washington Acad. Sci. Jour., vol. 6, pp. 67-68, 1916.

	A	B		A	B
SiO <sub>2</sub> .....	45.04	46.55	H <sub>2</sub> O.....	None	} 14.04
Al <sub>2</sub> O <sub>3</sub> .....	40.70	38.90	H <sub>2</sub> O+.....	14.08	
Fe <sub>2</sub> O <sub>3</sub> .....	Trace	Trace	TiO <sub>2</sub> .....	Trace	
MgO.....	Trace	Trace		100.04	99.49
CaO.....	.22	Trace			
Na <sub>2</sub> O.....	Trace	Trace			

## FELDSPAR

Primary feldspar (microcline-andesine antiperthite) from Roseland, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-189.

SiO <sub>2</sub> .....	61.44	H <sub>2</sub> O.....	0.30
Al <sub>2</sub> O <sub>3</sub> .....	23.47	H <sub>2</sub> O+.....	.20
Fe <sub>2</sub> O <sub>3</sub> , FeO.....	.20	BaO.....	.19
MgO.....	.05	TiO <sub>2</sub> .....	.10
CaO.....	5.00		
Na <sub>2</sub> O.....	5.23		100.26
K <sub>2</sub> O.....	4.25		

## GARNET

A-E. Collected by C. S. Ross, and described in Prof. Paper 179, p. 63, 1935. Analyses A-D by J. G. Fairchild, record C-890; E, by W. T. Schaller, record C-945. A, Ore Knob, N. C.; B, Ducktown, Tenn.; C, Monarat, Va.; D-E, Cullowhee, N. C.

F. Almandite collected by C. F. Park, Jr., from Battle Branch mine, Auraria, Ga. Analysis by R. C. Wells, record D-399.

G. Another garnet collected by C. F. Park, Jr., at Battle Branch mine. Analysis by R. E. Stevens, record D-448.



	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	38.30	37.64	36.59	35.62	35.61	36.18	39.79
Al <sub>2</sub> O <sub>3</sub> .....	20.51	20.59	19.63	None	.28	20.10	19.59
Fe <sub>2</sub> O <sub>3</sub> .....	.40	.86	.60	29.58	29.32	1.27	2.38
FeO.....	24.92	18.44	11.77	3.43	3.86	33.06	28.38
MnO.....	7.73	16.98	19.18	Trace	.55	.39	1.02
MgO.....	.40	1.75	1.20	Trace	None	2.09	2.36
CaO.....	8.30	4.12	8.82	31.50	30.12	5.52	5.72
TiO <sub>2</sub> .....						1.26	.88
	100.56	100.38	97.79	100.13	99.74	99.87	100.12

G-S. Garnet, mainly spessartite, collected by D. F. Hewett from the Piedmont crystalline belt; G-I from pegmatites, J-O from veins, P-S disseminated. Analyses G-L by Charles Milton, M-Q by R. S. Stevens, R-S by J. J. Fahey, record D-398.

G. Flat Rock mine, 4 miles northwest of Spruce Pine, N. C.

H. 2.5 miles west of Spruce Pine, N. C.

I. Wheatley mine, 3 miles east of Moneta, Va.

J. Hart mine, Union Point, Ga.

K. Iron mine, West Hawley, Mass. (garnet and quartz).

L. Iron mine, West Hawley, Mass. (calculated as garnet).

M. Betts mine, West Cunningham, Mass.

N. Rankin prospect, Kings Mountain, N. C.

O. Bald Knob, N. C.

P. Gossan Lead, Va.

Q. Higdon Mountain, Macon County, N. C.

R. Beam farm, Kings Mountain district, S. C.

S. Shooting Creek, N. C.

	G	H	I	J	K	L	M
SiO <sub>2</sub> .....	37.56	37.28	36.71	37.95	46.94	37.50	36.49
Al <sub>2</sub> O <sub>3</sub> .....	20.90	20.31	19.59	19.89	16.61	19.60	19.41
Fe <sub>2</sub> O <sub>3</sub> .....	.03	.17	None	.84	.25	.29	2.15
FeO.....	15.47	13.52	13.55	13.43	11.00	12.98	24.19
MgO.....	1.48	.69	.18	2.16	1.03	1.22	1.92
CaO.....	1.05	1.22	.39	3.48	3.27	3.86	5.29
TiO <sub>2</sub> .....	.20	.26	.28	.21	.11	.13	.69
MnO.....	23.96	26.62	28.72	21.96	20.81	24.56	9.69
ZnO.....	None						
	100.65	100.07	99.42	99.92	100.02	100.14	99.83

	N	O	P	Q	R	S
SiO <sub>2</sub> .....	35.68	36.03	36.40	37.32	44.23	36.71
Al <sub>2</sub> O <sub>3</sub> .....	19.07	19.25	19.56	19.24	11.52	16.86
Fe <sub>2</sub> O <sub>3</sub> .....	3.60	1.81	3.33	3.12	5.62	3.24
FeO.....	7.10	17.85	16.68	7.90	12.06	31.98
MgO.....	.91	1.25	2.50	1.55	2.90	1.51
CaO.....	3.30	6.54	5.59	8.44	3.04	3.90
TiO <sub>2</sub> .....	.25	.52	.37	.05	.80	.20
MnO.....	30.53	16.49	15.65	23.13	19.96	5.88
ZnO.....						
	100.44	99.74	100.08	100.76	100.13	100.28

T. Spessartite from Katerina mine, Hiriart Hill, Pala, Calif. Analysis by W. T. Schaller, record 2869.

U. Uvarovite, submitted by W. E. Smith, Daggett, Calif. Analysis by E. P. Henderson, record C-982.

	T	U		T	U
SiO <sub>2</sub> .....	37.06	35.83	CaO.....	0.08	34.56
Al <sub>2</sub> O <sub>3</sub> .....	21.96	9.13	Cr <sub>2</sub> O <sub>3</sub> .....		17.26
Fe <sub>2</sub> O <sub>3</sub> .....	None	2.61	MnO.....	20.41	
FeO.....	20.05				
MgO.....	Trace	.22		99.56	99.61





## GILLESPIE

From Dry Delta, Alaska Range, near Fairbanks, Alaska, collected by P. S. Smith. Analysis by W. T. Schaller, record C-396.

SiO <sub>2</sub> .....	50.08	Mn <sub>2</sub> O <sub>3</sub> .....	0.14
FeO.....	14.60	Insoluble in HCl.....	2.20
BaO.....	31.02	H <sub>2</sub> O.....	.82
Al <sub>2</sub> O <sub>3</sub> .....	.34		
Fe <sub>2</sub> O <sub>3</sub> .....	.56		99.76

## GLAUCONITE

A-F. Glauconitic greensand collected by G. R. Mansfield in New Jersey and described in Bull. 727, 1922. Analyses by R. K. Bailey, record 3263. A, Sewell; B, Elmwood; C, Woodstown; D, Birmingham; E, magnetically separated glauconite from composite sample representing 12 feet of greensands from Sewell; F, magnetically separated glauconite from composite sample representing 12 feet of greensand from Elmwood.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	50.38	49.50	50.32	68.90	50.58	49.47
Fe <sub>2</sub> O <sub>3</sub> .....	18.69	18.27	18.38	8.91	19.50	19.46
FeO.....	2.84	3.03	3.02	1.52	2.98	3.36
Al <sub>2</sub> O <sub>3</sub> .....	7.83	6.52	7.53	3.52	6.72	5.59
CaO.....	.37	1.77	.65	2.10	.34	.60
MgO.....	3.54	3.78	3.82	1.90	4.10	3.96
K <sub>2</sub> O.....	7.85	7.37	7.88	3.56	8.26	8.04
Na <sub>2</sub> O.....	.30	.26	.22	.82	.04	.15
CO <sub>2</sub> .....	.10	.30	.15	1.00	.30	.56
P <sub>2</sub> O <sub>5</sub> .....	.28	1.09	.34	1.05	.27	1.06
H <sub>2</sub> O.....	8.70	8.98	8.58	7.68	7.76	8.54
	100.88	100.87	100.89	100.96	100.83	100.79

G-L. Carbonaceous matter other than carbonate in glauconite submitted by G. R. Mansfield, determined by E. T. Erickson, record C-302. For details of locations see Bull. 727, 1922.

G. Hole, 6 Woodstown. C, 0.07.

H. Locality 35, hole 10, depth 15 feet. C, 0.24.

I. Marlton district, hole 15, depth 28 feet. C, 0.10.

J. Locality 96, hole 17, depth 15 feet. C, 0.21.

K. Sewell. Grains separated magnetically from washed greensand. C, 0.10.

L. Elmwood Road. Grains separated magnetically. C, 0.09.

M. Glauconite from a lead mine in Missouri, submitted by C. S. Ross and described in U. S. Nat. Mus. Proc., vol. 69, art. 2, pp. 1-15, 1926. Analysis by G. V. Brown, record 3271. No TiO<sub>2</sub> or Na<sub>2</sub>O.

N. From Huntington, Oreg., collected by T. E. Stephenson. Analysis by E. P. Henderson, record C-528.

O. Glauconite from vesicular basalt, 23 miles east of Reno, Nev., collected by C. S. Ross. Small sample.

P. Similar material from basalt, Sandoval County, N. Mex. 0.5-gram sample. Analyses O, P by R. C. Wells, record D-468.

	M	N	O	P		M	N	O	P
SiO <sub>2</sub> .....	48.66	49.05	55.61	50.6	H <sub>2</sub> O+.....	4.62	11.79	4.40	6.9
Al <sub>2</sub> O <sub>3</sub> .....	8.46	7.96	.79	4.2	P <sub>2</sub> O <sub>5</sub> .....	.12	None	None	Trace
Fe <sub>2</sub> O <sub>3</sub> .....	18.80	19.66	17.19	14.1	MnO.....	.01	None	.09	
FeO.....	3.98	2.34	4.02	3.3	SO <sub>3</sub> .....	None	None	None	
MgO.....	3.56	1.17	7.26	6.4	Li <sub>2</sub> O.....	None	None	None	
CaO.....	.62	.75	.21	3.1	TiO <sub>2</sub> .....	None	None	None	Trace
Na <sub>2</sub> O.....	None	.78	.19	.4	CO <sub>2</sub> .....	None	None	None	
K <sub>2</sub> O.....	8.31	6.18	10.03	8.7					
H <sub>2</sub> O.....	1.94		.48	1.4		99.08	99.68	100.27	99.1

<sup>1</sup>Total H<sub>2</sub>O.

## GRIFFITHITE

From Cahuenga Pass, Calif. Described by E. S. Larsen and George Steiger in Am. Jour. Sci., 5th ser., vol. 15, p. 1, 1928. Analysis by Steiger, record 3112.

SiO <sub>2</sub> .....	39.64	CaO.....	2.93	H <sub>2</sub> O+.....	4.90
Al <sub>2</sub> O <sub>3</sub> .....	9.05	Na <sub>2</sub> O.....	.71		
Fe <sub>2</sub> O <sub>3</sub> .....	7.32	K <sub>2</sub> O.....	None		100.49
FeO.....	7.83	TiO <sub>2</sub> , SrO.....	None		
MgO.....	15.80	H <sub>2</sub> O.....	12.31	Specific gravity.....	2.309



## GRUNERITE

A. From Mount Humboldt, Mich., collected by Stephen Richarz. Analysis by J. J. Fahey, record D-263.

B. From an ilmenite vein near Bedford, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-286.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	50.54	51.50	MnO.....	2.02	0.53	H <sub>2</sub> O-----	None	-----
Al <sub>2</sub> O <sub>3</sub> .....	2.14	1.76	CaO.....	None	None	H <sub>2</sub> O+-----	0.73	01.65
Fe <sub>2</sub> O <sub>3</sub> .....	None	.12	MgO.....	4.64	10.38			
FeO.....	39.37	33.42	Na <sub>2</sub> O, K <sub>2</sub> O....	.35	.30		99.89	99.90
TiO <sub>2</sub> .....	.10	.24						

## HALLOYSITE

Samples submitted by C. S. Ross. The properties of halloysite are fully described by Ross and Kerr in Prof. Paper 185-G, 1935.

A. From Peppers, N. C. Analysis by E. T. Erickson, record D-137.

B. From Hickory, N. C. Analysis by J. G. Fairchild, record C-993.

C. From Huron, Lawrence County, Ind. Analysis by J. G. Fairchild, record D-155.

D. Same locality. Analysis by L. T. Richardson, record D-67.

E. From Liège, Belgium. Analysis by L. T. Richardson, record D-67.

F. From Iyo, Japan. Analysis by J. J. Fahey, record D-200.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	44.68	44.08	43.67	40.26	44.75	41.63
Al <sub>2</sub> O <sub>3</sub> .....	38.59	39.20	37.91	37.95	36.94	20.53
Fe <sub>2</sub> O <sub>3</sub> .....	.39	.10	.26	{ <sup>(1)</sup> .30	{ <sup>(1)</sup> .31	.23
FeO.....		None	Trace	{ <sup>(1)</sup>	{ <sup>(1)</sup>	.15
MgO.....	.08	.05	None	.22	.11	None
CaO.....	.18	None	None	.74	{.60	.10
Na <sub>2</sub> O.....	.11	.20				
K <sub>2</sub> O.....	.05					
H <sub>2</sub> O.....	1.55	1.44	3.79	4.45	2.53	9.35
H <sub>2</sub> O+.....	14.90	14.74	14.50	15.94	14.89	12.12
TiO <sub>2</sub> .....	Trace	Trace				None
P <sub>2</sub> O <sub>5</sub> .....			.12			.22
CuO.....						14.77
CO <sub>2</sub> .....						.31
SO <sub>3</sub> .....						.28
	100.53	90.81	100.25	99.86	100.13	99.69

<sup>1</sup> Doubtful trace.

G. From Edwards Plateau region, Texas. Analysis by R. K. Bailey, record D-125. Described by Ross and Kerr in Prof. Paper 185-G, 1935.

H. From Gardner mine, 4 miles northeast of Huron, Ind., collected by H. Ries and described as "indianaite" in Bull. 708, 1922.

I. From Mississippi, collected by M. A. Pentz. Analysis by Charles Milton, record D-144.

J. White rock, possibly halloysite, from Tintic, Utah, collected by Waldemar Lindgren. Analysis by R. C. Wells, record 2937.

K. From Cerro Gordo, Inyo County, Calif. Analysis by Chase Palmer, record 2996.

	G	H	I	J	K		G	H	I	J	K
SiO <sub>2</sub> .....	44.50	43.47	44.34	41.20	43.11	K <sub>2</sub> O.....	0.14		0.04		
Al <sub>2</sub> O <sub>3</sub> .....	38.68	38.03	37.39	36.90	38.60	H <sub>2</sub> O.....	1.17	3.83	2.00	{22.60	
Fe <sub>2</sub> O <sub>3</sub> .....	.24		{.42			H <sub>2</sub> O+.....	14.38	14.73	15.09		
FeO.....		.25				TiO <sub>2</sub> .....		None	Trace		
MgO.....	.05		.04			Ignition.....					17.52
CaO.....	None		.17								
Na <sub>2</sub> O.....	1.19		.17				100.35	100.31	99.66	100.70	99.23



## HEDENBERGITE

A. From Hanover, N. Mex., collected by A. C. Spencer. Analysis by W. T. Schaller, record D-237.

B. From Yakuki mine, northeastern Japan.

C. From Sasagatani mine, Japan. Analyses B, C by J. G. Fairchild, record D-245; both specimens studied optically by W. T. Schaller.

D. From Cranberry, N. C., collected by C. S. Ross. Analysis by E. P. Henderson, record C-892.

E. From Cranberry, N. C., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-269.

F. From Ducktown, Tenn., collected by F. B. Laney and separated by C. S. Ross. Analysis by J. G. Fairchild, record D-194.

G. From Independence, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-396.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	48.64	48.18	48.69	48.97	48.08	51.46	49.26
Al <sub>2</sub> O <sub>3</sub> .....	.88	.05	.05	.98	2.16	.98	.74
Fe <sub>2</sub> O <sub>3</sub> .....	1.16	1.47	1.35	2.59	2.66	None?	2.17
FeO.....	15.45	24.90	21.85	23.10	21.30	16.93	19.65
MgO.....	.03	.39	2.01	3.28	3.00	7.54	2.11
MnO.....	10.77	3.25	3.76	.73	.46	.10	3.56
ZnO.....	.24	None	None	None	None	None	None
CaO.....	21.99	22.24	22.42	20.63	22.00	23.08	21.88
H <sub>2</sub> O.....	.06						
H <sub>2</sub> O+.....	.99						.66
CO <sub>2</sub> .....	.14						
	100.35	100.48	100.13	100.28	99.99	100.09	100.03
Specific gravity.....	3.494						

## HISINGERITE

Specimen from Bellevue King mine, Bellevue, Idaho. Analysis by W. T. Schaller, record 2868.

SiO <sub>2</sub> .....	38.13	H <sub>2</sub> O.....	13.20
Fe <sub>2</sub> O <sub>3</sub> .....	36.66	H <sub>2</sub> O+.....	8.53
FeO.....	.84		
MgO.....	2.45		99.81
MnO.....	Trace		

## HORNBLLENDE

Specimen from vicinity of Bedford, Va., collected by C. S. Ross. Analysis by J. G. Fairchild, record D-286.

SiO <sub>2</sub> .....	46.20	CaO.....	10.02	TiO <sub>2</sub> .....	0.33
Al <sub>2</sub> O <sub>3</sub> .....	6.94	Na <sub>2</sub> O.....	.84	MnO.....	.24
Fe <sub>2</sub> O <sub>3</sub> .....	4.50	K <sub>2</sub> O.....	.48		
FeO.....	21.00	H <sub>2</sub> O+.....	2.00		100.03
MgO.....	7.48				

## ILVAITE

From T. 36 N., R. 9 E., Thunder Creek region, Wash., collected by J. S. Diller. Analysis by R. C. Wells, record 3204.

SiO <sub>2</sub> .....	30.8	MnO.....	0.8
TiO <sub>2</sub> .....	Trace	Al <sub>2</sub> O <sub>3</sub> , etc.....	.6
Fe <sub>2</sub> O <sub>3</sub> .....	25.1	FeS <sub>2</sub> .....	( <sup>1</sup> )
FeO.....	24.2		
CaO.....	16.6		98.7
MgO.....	.6		

<sup>1</sup> Present.

## INESITE

Specimen from Quinault, Wash., submitted by J. J. Glass. Analysis by J. G. Fairchild, record D-173.

SiO <sub>2</sub> .....	45.67	H <sub>2</sub> O.....	2.13
MnO.....	35.10	H <sub>2</sub> O+.....	6.53
FeO.....	.92		
CaO.....	9.33		100.54
MgO.....	.86		



## JEFFERSONITE

From Ogdensburg, N. J., U. S. National Museum no. 49651. Analysis by J. G. Fairchild, record D-269.

SiO <sub>2</sub> .....	47.22	ZnO.....	8.76	H <sub>2</sub> O.....	0.28
Al <sub>2</sub> O <sub>3</sub> .....	1.76	MgO.....	2.82	TiO <sub>2</sub> .....	None
Fe <sub>2</sub> O <sub>3</sub> .....	3.20	CaO.....	20.04		
FeO.....	6.93	Na <sub>2</sub> O.....	.32		
MnO.....	8.65				99.98

## JOHANNSENITE

A-C. Theoretically MnCa(SiO<sub>3</sub>)<sub>2</sub>, named by W. T. Schaller. Analysis A by L. T. Richardson; Aa, B, and C by W. T. Schaller, with MnO by J. G. Fairchild, records D-86 and D-193.

A, Aa. Specimen collected by J. T. Pardee from California vein, Musick mine, Bohemia district, Lane County, Oreg.

B. From Schio, Vicenza, Italy, collected by D. F. Hewett.

C. From Italy, Roebling collection.

D. From Hanover, N. Mex., collected by A. C. Spencer. Analysis by W. T. Schaller, record D-237.

E. From Tetela de Ocampo, Pueblo, Mexico. Furnished by Manuel Santillán. Analysis by W. T. Schaller, record D-388. The sample is estimated to be 79 percent johannsenite, 3 percent hedenbergite, 1 percent diopside, 17 percent rhodonite, and 2 percent quartz.

F. From Franklin, N. J., separated by J. J. Glass from pink bustamite. Studied by W. T. Schaller. Analysis by J. G. Fairchild, record D-245.

	A	Aa	B	C	D	E	F
SiO <sub>2</sub> .....	42.80	42.88	47.62	48.16	48.15	50.24	50.30
Al <sub>2</sub> O <sub>3</sub> .....	Trace?		.81	None	.31	.32	
FeO.....	2.93	3.46	4.31	.50	4.28	.88	2.59
Fe <sub>2</sub> O <sub>3</sub> .....	Trace?	.59	.62	None	1.58	.25	
MgO.....	1.34	2.06	2.74	.23	.48	.26	6.19
ZnO.....	.64		.21	.28	.14		3.27
MnO.....	23.56	23.65	21.15	27.82	21.37	29.24	14.85
CaO.....	21.10	20.88	20.15	20.56	20.88	18.16	22.97
CO <sub>2</sub> .....	3.86		2.07	1.02	1.39		
SO <sub>2</sub> .....	1.62	None					
H <sub>2</sub> O.....	.62	.53	.19	.55	.24	.15	
H <sub>2</sub> O+.....	1.50	1.63	.25	.58	.96	.49	
MnO <sub>2</sub> .....				.11			
	99.97	95.68	100.12	99.81	99.78	100.69	100.17
Specific gravity.....	3.23				3.282		

## KAOLINITE

A. Washed sample from Woodrow, N. C., collected by W. S. Bayley. Analysis by George Steiger, record 3245.

B. Material embedding creedite, Wagon Wheel Gap, Colo., collected by E. S. Larsen. Analysis by R. C. Wells, record 3069. Described in Nat. Acad. Sci. Proc., vol. 2, pp. 360-365, 1916.

C. From Owensville, Mo., submitted by John Skornia through Jefferson Middleton. Analysis by R. C. Wells, record 3182.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	46.41	44.2	44.45	TiO <sub>2</sub> .....	None		1.21
Al <sub>2</sub> O <sub>3</sub> .....	37.76	40.2	38.37	Nu <sub>2</sub> O.....	.17		
FeO.....	.70		.78	K <sub>2</sub> O.....	.55		
Fe <sub>2</sub> O <sub>3</sub> .....			.14	P <sub>2</sub> O <sub>5</sub> .....	.04		
MgO.....	.09	Trace	.26				
CaO.....	None	.3	.27		100.28	97.9	99.28
H <sub>2</sub> O.....	1.10	13.2	.98				
H <sub>2</sub> O+.....	13.46		12.82		Specific gravity.....		2.548

## LEPIDOLITE

From Katerina mine, Pala, Calif., collected by W. T. Schaller. Determination of alkalis only by R. E. Stevens, record D-377.

Li <sub>2</sub> O.....	3.51	Rb <sub>2</sub> O.....	1.11
Na <sub>2</sub> O.....	1.27	Cs <sub>2</sub> O.....	.13
K <sub>2</sub> O.....	10.32		



## LEUCHTENBERGITE

From tungsten vein near brucite deposit, NW $\frac{1}{4}$  sec. 36, T. 12 S., R. 36 E., Paradise Range, Nye County, Nev., collected by Eugene Callaghan. Analysis by Charles Milton, record D-170.

SiO <sub>2</sub> .....	31.02	CaO.....	0.02	H <sub>2</sub> O+.....	12.77
Al <sub>2</sub> O <sub>3</sub> .....	20.79	TiO <sub>2</sub> .....	Trace	Na <sub>2</sub> O.....	.51
Fe <sub>2</sub> O <sub>3</sub> .....	.04	MnO.....	Trace	K <sub>2</sub> O.....	.07
FeO.....	1.20	P <sub>2</sub> O <sub>5</sub> .....	.01		
MgO.....	34.25	H <sub>2</sub> O-.....	.03		100.71

## LEVERRIERITE

A. From Manhattan, Nev., carrying gold; collected by H. G. Ferguson and described in Bull. 723, 1924. Stated to be pure by E. S. Larsen. Determinations by R. K. Bailey, record C-124.

B. From National City, a few miles south of San Diego, Calif., submitted for identification. Analysis by W. T. Schaller, record C-316. Probably bentonite.

C. From Elko, Nev., submitted by Jefferson Middleton. Analysis by E. P. Henderson, record C-370.

	A	B	C		A	B	C
SiO <sub>2</sub> .....		54.36	49.30	H <sub>2</sub> O-.....	4.56	11.09	} 22.40
Al <sub>2</sub> O <sub>3</sub> .....		21.14	21.88	H <sub>2</sub> O+.....	16.15	8.16	
MgO.....			3.06	MgO, alkalis.....		4.46	
CaO.....		.79	1.20				
K <sub>2</sub> O.....	0.31					100.00	97.84

## MICROCLINE

A-I. Samples from Connecticut pegmatites collected by F. J. Katz and described in Mineral Resources for 1915, pt. 2, pp. 43-49, 1917. Partial analyses by George Steiger, record 3167. A-B, Chatham; C-D, Portland; E-I, Glastonbury.

	A	B	C	D	E	F	G	H	I
Na <sub>2</sub> O.....	2.96	2.37	2.76	2.95	2.52	2.42	2.52	2.32	2.28
K <sub>2</sub> O.....	12.51	12.63	12.65	12.32	12.87	13.12	12.89	12.78	13.06

J, K. A sample of green microcline, collected by J. J. Glass at Amelia, Va., was analyzed for alkalis only by R. E. Stevens, record D-331 (J). White microcline in sharp contact with the green gave the results under K.

L-O. Samples collected by F. J. Katz. Analyses by George Steiger, record 3167. L-N, from Batchellerville, N. Y.; O, from Bedford, N. Y.

	J	K	L	M	N	O	
Na <sub>2</sub> O.....	} 01.54	0.084	5.38	2.32	2.96	2.54	
Li <sub>2</sub> O.....		.08					
K <sub>2</sub> O.....		14.38	15.44	11.92	13.15	12.63	12.65
Rb <sub>2</sub> O.....		1.02	.42				
Cs <sub>2</sub> O.....		Trace	.10				

## MONTICELLITE

From Ivanpah quadrangle, Calif.-Nev., collected by D. F. Hewett. Analysis by W. T. Schaller, record D-192.

Insoluble diopside.....	2.55	CaO.....	33.08
SiO <sub>2</sub> .....	37.36	H <sub>2</sub> O-.....	.04
FeO.....	1.40	H <sub>2</sub> O+.....	1.24
MnO.....	.04		
MgO.....	24.90		100.61



MONTMORILLONITE

[For other analyses of montmorillonite see "Bentonitic clays."]

- A-F. Six samples of montmorillonite submitted by C. S. Ross.
- A. From Atzacapozalco, Mexico. Analysis by E. T. Erickson, record D-432.
- B. Near Laurel, Miss. Analysis by J. J. Fahey, record D-203.
- C. Near Jackson, Miss. Analysis by R. C. Wells, record D-268.
- D. Husband farm, Smith County, Miss. Porous variety.
- E. Same, dense variety. Analyses D, E by R. E. Stevens, record D-355.
- F. Montmorillonite low in iron, exact locality unknown. Analysis by J. G. Fairchild, record C-993.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	50.44	49.48	50.20	50.37	50.39	51.50
Al <sub>2</sub> O <sub>3</sub> .....	16.26	17.75	16.19	17.11	17.37	19.44
Fe <sub>2</sub> O <sub>3</sub> .....	5.38	3.33	4.13	2.68	2.84	.10
FeO.....	Trace	.15	None	.20	Trace	-----
MgO.....	3.92	4.42	4.12	4.59	4.56	5.07
CaO.....	.72	.16	2.18	1.23	1.29	.48
Na <sub>2</sub> O.....	-----	.12	.17	.56	.46	.20
K <sub>2</sub> O.....	-----	.12	.16	.09	.04	-----
H <sub>2</sub> O.....	16.00	18.26	15.58	12.29	13.31	14.50
H <sub>2</sub> O+.....	6.30	5.86	7.57	10.93	10.11	8.04
TiO <sub>2</sub> .....	.42	.29	.20	-----	-----	None
	99.44	99.82	100.50	100.05	100.37	99.33

- G-M. Seven samples submitted by C. S. Ross. Analyses G-K by J. G. Fairchild, record C-993 and D-289; L by J. J. Fahey, record D-174; M by R. E. Stevens, record D-364.

- G. Montmorillonite from San Diego County, Calif.
- H. From Amargosa Valley, Calif., washed.
- I. Pink montmorillonite from pegmatite, San Diego County.
- J. Montmorillonite (galapectite) from Anglar, France.
- K. Alteration product of pollucite from Greenwood, Maine.
- L. Montmorillonite from locality near Dixon, N. Mex.
- M. From Santa Rita, N. Mex.

	G	H	I	J	K	L	M
SiO <sub>2</sub> .....	53.96	54.58	50.06	50.86	54.28	51.37	54.15
Al <sub>2</sub> O <sub>3</sub> .....	15.44	16.44	21.32	18.76	22.94	15.41	15.99
Fe <sub>2</sub> O <sub>3</sub> .....	1.12	2.59	.22	2.07	.24	.78	.59
FeO.....	Trace	.11	Trace	-----	-----	.14	.06
MgO.....	6.99	4.90	4.42	3.48	2.92	6.22	4.48
CaO.....	.80	.72	1.26	1.76	3.18	Trace	1.90
Na <sub>2</sub> O.....	.94	3.02	.33	.37	-----	.79	.42
K <sub>2</sub> O.....	.54	.81	.19	-----	.08	.46	.19
Li <sub>2</sub> O.....	-----	-----	-----	-----	.02	-----	-----
H <sub>2</sub> O.....	14.22	11.10	14.06	22.34	7.82	15.76	13.29
H <sub>2</sub> O+.....	6.34	5.49	7.56	-----	8.70	8.20	8.99
TiO <sub>2</sub> .....	.19	.18	Trace	Trace	.06	.29	.11
MnO.....	-----	-----	.13	-----	-----	-----	-----
Cs <sub>2</sub> O.....	-----	-----	-----	-----	None	-----	-----
Cl.....	.29	-----	-----	-----	-----	Trace	-----
SO <sub>2</sub> .....	-----	-----	-----	-----	-----	.23	-----
	100.83	99.94	99.55	99.64	100.24	99.65	100.17

- N, O. Two samples of montmorillonite submitted by C. S. Ross.
- N. From locality west of Leakey, Real County, Tex. Analysis by J. J. Fahey, record D-124.
- O. From Rideout, Utah. Analysis by J. G. Fairchild, record C-993.
- P-R. Three samples studied by P. G. Nutting. Analyses by J. G. Fairchild, record D-467.
- P. Sanders, Apache County, Ariz. Sample from Filtrol Co. White.
- Q. Westcliff, Colo. Pink, conchoidal. Compare analysis under clays, p 67.
- R. New Mexico, sec. 6, T. 20 N., R. 9 E.



	N	O	P	Q	R
SiO <sub>2</sub> .....	51.74	56.86	51.20	55.29	52.30
Al <sub>2</sub> O <sub>3</sub> .....	22.81	16.00	15.12	14.86	14.43
Fe <sub>2</sub> O <sub>3</sub> .....	.39	.98	1.41	1.23	2.00
FeO.....		Trace			
MgO.....	3.32	4.13	5.22	4.30	6.15
CaO.....	Trace	1.52	2.71	2.26	2.12
Na <sub>2</sub> O.....	.17	.22	.50	.42	.50
K <sub>2</sub> O.....	.26	.27	.08	.28	.52
H <sub>2</sub> O.....	11.84	13.68	16.78	14.23	15.78
H <sub>2</sub> O+.....	9.19	6.43	6.92	7.12	6.55
TiO <sub>2</sub> .....	Trace	.06	.10	.06	.20
P <sub>2</sub> O <sub>5</sub> .....				.02	.02
SO <sub>3</sub> .....	.11				
MnO.....			.03	.15	.05
	99.83	100.15	100.07	100.52	100.62

## MORDENITE

From Marysvale, Utah. Analysis by W. T. Schaller, record 3073.

SiO <sub>2</sub> .....	67.35	H <sub>2</sub> O.....	5.13
Al <sub>2</sub> O <sub>3</sub> .....	11.49	H <sub>2</sub> O+.....	8.82
CaO.....	3.87		
K <sub>2</sub> O.....	.11		99.40
Na <sub>2</sub> O.....	2.63		

## MUSCOVITE

A. From Waynesville, N. C. Partly leached or decomposed. Collected by W. S. Bayley. Analysis by George Steiger, record 3245.

B. Collected by W. T. Schaller at Harding mine, 9½ miles due east of Embudo, N. Mex. Analysis by E. P. Henderson, record C-636.

C. Collected by W. T. Schaller from east side of Rio Grande, 1 mile southwest of Cieneguilla and about 9 miles northeast of Embudo, N. Mex. Pink. Analysis by E. P. Henderson, record C-632.

D. Fine-grained micaceous material coating quartz, apparently a variety of muscovite, from Melones, Calaveras County, Calif., submitted by C. S. Ross. Analysis by J. J. Fahey, record D-124.

E. From sedimentary beds, Graves County, Ky., submitted by C. S. Ross. Analysis by J. G. Fairchild, record D-289.

F. Collected by C. F. Park, Jr., from Battle Branch mine, Auraria, Ga. Analysis by R. E. Stevens, record D-412.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	40.79	44.80	45.16	50.60	49.37	45.42
Al <sub>2</sub> O <sub>3</sub> .....	29.98	37.72	35.61	31.07	29.21	33.52
Fe <sub>2</sub> O <sub>3</sub> .....	8.07	.67	2.95	3.00	1.54	1.47
FeO.....	2.43					1.11
MgO.....	2.71			.72	2.77	1.22
CaO.....	.45			None	None	1.12
Na <sub>2</sub> O.....	.38	1.40	1.03	None	.14	1.34
K <sub>2</sub> O.....	3.47	10.66	10.32	6.43	9.72	8.06
H <sub>2</sub> O.....	1.20	4.52	4.36	.13	.75	5.89
H <sub>2</sub> O+.....	9.34					
TiO <sub>2</sub> .....	1.28			.83	.19	.39
F.....		.20				
MnO.....			.63			None
Li <sub>2</sub> O.....		Trace	None			
Mn <sub>2</sub> O <sub>3</sub> .....		.21				
Rb, Cs.....		None				
	100.15	100.18	100.06	100.25	100.57	99.54
Less O.....		.08				
		100.10				

## NONTONITE

A. From Woody, Calif. Described by E. S. Larsen and George Steiger in Am. Jour. Sci., 5th ser., vol. 15, p. 1, 1928. Analysis by George Steiger, record 3112.

B. From Chevy Chase, D. C. Analysis by L. T. Richardson, record D-67.



- C. From Santa Rita, N. Mex. Analysis by R. C. Wells, record D-432.  
 D. From Sandy Ridge, N. C., in arkosic sedimentary rock.  
 E. From Spruce Pine, N. C., in altered pegmatite. Samples B-E submitted by C. S. Ross. Analyses D, E by L. T. Richardson, record D-67.

	A	B	C	D	E
SiO <sub>2</sub> .....	47.51	46.65	40.48	41.38	41.88
Al <sub>2</sub> O <sub>3</sub> .....	.37	17.65	6.00	9.84	11.90
Fe <sub>2</sub> O <sub>3</sub> .....	35.17	18.39	29.33	27.47	26.20
FeO.....	None	Trace	.26	Trace	Trace
MgO.....	1.40	Trace	.31	Trace	.10
CaO.....	2.50	1.21	2.90	Trace	.67
Na <sub>2</sub> O.....	.09	.55	{	-----	}
K <sub>2</sub> O.....	.06				
Ti, Sr.....	None	None	None	-----	-----
H <sub>2</sub> O.....	7.16	5.55	15.39	12.10	7.67
H <sub>2</sub> O+.....	5.90	10.81	5.65	9.25	10.78
	100.16	100.81	100.32	100.04	99.72
Specific gravity.....	2.495	-----	-----	-----	-----

## PENNINITE

From brucite deposit, Paradise Range, Nev., collected by Eugene Callaghan. Analysis by J. J. Fahey, record D-184. (Na,K)<sub>2</sub>O less than 0.10 percent.

SiO <sub>2</sub> .....	36.56	CaO.....	0.02
Al <sub>2</sub> O <sub>3</sub> .....	11.80	H <sub>2</sub> O.....	.43
Fe <sub>2</sub> O <sub>3</sub> .....	None	H <sub>2</sub> O+.....	13.19
TiO <sub>2</sub> .....	None		
FeO.....	1.27		100.42
MgO.....	37.15		

## PHLOGOPITE

From Verdiolite quarry, near Easton, Pa., collected by W. S. Bayley. Partial analysis made on 4 grams by J. G. Fairchild, record C-520.

SiO <sub>2</sub> .....	42.16	Na <sub>2</sub> O.....	0.30
Al <sub>2</sub> O <sub>3</sub> .....	11.08	H <sub>2</sub> O.....	None
Fe <sub>2</sub> O <sub>3</sub> , FeO.....	.58	Loss on ignition.....	2.14
MgO.....	29.52	F.....	1.10
CaO.....	None		
K <sub>2</sub> O.....	9.96		96.84

## POLLUCITE

From Tin Mountain, S. Dak. U. S. National Museum no. 96487. Analysis by R. E. Stevens, record D-370.

SiO <sub>2</sub> .....	45.66	H <sub>2</sub> O.....	2.17
Al <sub>2</sub> O <sub>3</sub> .....	16.64	H <sub>2</sub> O+.....	.42
Fe <sub>2</sub> O <sub>3</sub> .....	.22	TiO <sub>2</sub> .....	None
FeO.....	.10	Li <sub>2</sub> O.....	.22
MgO.....	.29	Rb <sub>2</sub> O.....	None
CaO.....	.36	Cs <sub>2</sub> O.....	31.80
Na <sub>2</sub> O.....	2.12		
K <sub>2</sub> O.....	.14		100.14

## POTASH CLAY

A-B. Two gouge clays from Thunder Mountain district, Idaho, collected by C. P. Ross. Analyses by J. G. Fairchild, record C-993.

C. Potash clay from Evansville, Tenn., submitted by C. S. Ross. Analysis by J. G. Fairchild, record C-993.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	57.02	47.50	55.27	K <sub>2</sub> O.....	6.45	7.90	6.21
Al <sub>2</sub> O <sub>3</sub> .....	26.10	31.52	20.73	H <sub>2</sub> O.....	-----	-----	4.87
Fe <sub>2</sub> O <sub>3</sub> .....	.92	1.18	2.18	H <sub>2</sub> O+.....	8.20	9.92	6.50
FeO.....	.38	.50	.41	TiO <sub>2</sub> .....	None	Trace	.30
MgO.....	.50	.72	3.82	SrO.....	-----	-----	None
CaO.....	Trace	.64	Trace				
Na <sub>2</sub> O.....	None	.19	Trace		99.57	100.06	100.29



## RECTORITE

From Hot Springs region, Ark., submitted by C. S. Ross. Analysis by J. J. Fahey, record D-108.

SiO <sub>2</sub> .....	47.10	K <sub>2</sub> O.....	0.16
Al <sub>2</sub> O <sub>3</sub> .....	33.97	H <sub>2</sub> O-.....	8.34
Fe <sub>2</sub> O <sub>3</sub> .....	.31	H <sub>2</sub> O+.....	6.27
MgO.....	.01		
CaO.....	.42		100.46
Na <sub>2</sub> O.....	3.88		

## ROSCOEILITE

A. From Paradox Valley, Colo., collected by F. L. Hess. Analysis by R. C. Wells, record 2918.

B-D. From Colorado, collected by F. L. Hess. Analyses by W. T. Schaller, record C-734.

	A	B	C	D		A	B	C	D
Insoluble SiO <sub>2</sub> .....	47.27	78.36	76.79	77.21	TiO <sub>2</sub> .....	0.06			
Soluble SiO <sub>2</sub> .....					15.26	0.96	1.65	1.23	
Al <sub>2</sub> O <sub>3</sub> .....	19.18	6.23	4.44		BaO.....	Trace		.01	
Fe <sub>2</sub> O <sub>3</sub> .....	1.69				FeS <sub>2</sub> .....	.13			
MgO.....	.93				Li, Se.....	Traces			
CaO.....	.06								
Na <sub>2</sub> O.....	.24					99.29	97.37	95.74	
K <sub>2</sub> O.....	8.68	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )					
H <sub>2</sub> O-.....	1.62	3.85	3.76						
H <sub>2</sub> O+.....	4.17								

<sup>1</sup> Present.

## SAPONITE

A-C. Three specimens submitted by C. S. Ross. Analyses A, B by L. T. Richardson, record D-67; C by J. G. Fairchild, record D-75. A, Utah; B, C, Glasgow, Scotland.

D. Hydrous magnesium silicate occurring as angular fragments in magnesian clay in the Currant district, west of Ely, Nev. Submitted by Eugene Callaghan and W. W. Rubey. Analysis by Charles Milton, record D-426.

E, F. Saponite from Hector, Death Valley, Calif., submitted by C. S. Ross. Analysis E by J. G. Fairchild, record D-289; F by R. E. Stevens, record D-355.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	62.96	40.16	40.12	40.76	57.50	51.26
Al <sub>2</sub> O <sub>3</sub> .....	13.24	8.03	7.34	1.10	.68	.36
Fe <sub>2</sub> O <sub>3</sub> .....	2.66	8.50	8.69	.37	.24	.09
FeO.....		3.83	3.55			
MgO.....	7.78	19.40	19.90	33.40	25.98	23.25
CaO.....	.86	1.91	.85	Trace	.47	2.60
Na <sub>2</sub> O.....	.31			.05	2.48	3.47
K <sub>2</sub> O.....	.39			None	.45	.10
Li <sub>2</sub> O.....						.60
H <sub>2</sub> O-.....	12.66	11.15	19.56	8.90	3.52	11.56
H <sub>2</sub> O+.....	9.22	7.60		12.04	6.88	5.14
CO <sub>2</sub> .....				.87		1.35
TiO <sub>2</sub> .....			.10	.01	.02	
P <sub>2</sub> O <sub>5</sub> .....					.34	
SrO.....						Trace
	100.05	100.58	100.11	99.50	98.56	99.84

## SCHRÖTTERITE

A. From Styria, submitted by C. S. Ross. Analysis by J. J. Fahey, record D-200.

B. Hyaline coating on a lump of sandstone collected by H. Ries at Gardner mine, 4 miles northeast of Huron, Ind. Analysis by George Steiger, record 3248.

C. A poorly defined species received from W. S. Baldwin, Dalton, Ga. Analysis by E. P. Henderson, record C-667.



	A	B	C		A	B	C
SiO <sub>2</sub> .....	4.34	10.70	10.80	TiO <sub>2</sub> .....	None	None	.....
Al <sub>2</sub> O <sub>3</sub> .....	41.41	54.53	33.61	CO <sub>2</sub> .....	2.07	.....	.....
Fe <sub>2</sub> O <sub>3</sub> .....	.86	.37	.73	P <sub>2</sub> O <sub>5</sub> .....	9.23	.....	14.03
MgO.....	.22	.....	.98	SO <sub>3</sub> .....	.08	.....	.....
CaO.....	.20	.....	.....	CuO.....	1.80	.....	.....
(Na, K) <sub>2</sub> O.....	.10	.....	.....	ZnO.....	4.30	.....	.....
H <sub>2</sub> O.....	20.92	5.26	39.95				
H <sub>2</sub> O+.....	14.43	29.48				99.96	100.34

<sup>1</sup> Includes P<sub>2</sub>O<sub>5</sub>.

SEARLESITE

From Searles Lake, Calif., described by Larsen and Hicks, Am. Jour. Sci., 4th ser., vol. 38, pp. 437-440, 1914. Analysis by W. B. Hicks after deducting impurities, record 2908.

SiO <sub>2</sub> .....	58.41
B <sub>2</sub> O <sub>3</sub> .....	17.45
Na <sub>2</sub> O.....	13.73
K <sub>2</sub> O.....	1.07
H <sub>2</sub> O.....	9.31
	100.00

SEPIOLITE

From Duchesne County, Utah. Collected by W. H. Bradley and described in Prof. Paper 158, pp. 1-7, 1930. Analysis by E. T. Erickson, record C-964.

SiO <sub>2</sub> .....	35.92	TiO <sub>2</sub> .....	0.10
Al <sub>2</sub> O <sub>3</sub> .....	1.16	CO <sub>2</sub> .....	1.14
Fe <sub>2</sub> O <sub>3</sub> .....	.26	Loss on ignition, excluding CO <sub>2</sub> .....	42.06
MgO.....	16.34		
CaO.....	1.88		98.86

SERENDIBITE

From Warren County, N. Y., submitted by E. S. Larsen. Analysis by W. T. Schaller, record C-732. Formula: 4SiO<sub>2</sub>.3Al<sub>2</sub>O<sub>3</sub>.2CaO.4MgO.B<sub>2</sub>O<sub>3</sub>.

SiO <sub>2</sub> .....	76.30	MgO.....	15.44
Al <sub>2</sub> O <sub>3</sub> .....	34.05	B <sub>2</sub> O <sub>3</sub> .....	8.37
FeO.....	2.76		
CaO.....	13.30		100.22

SERICITE

A-E. From a pegmatite near Amelia, Va., collected by J. J. Glass. Analyses A, B, E by R. E. Stevens; C, D by J. G. Fairchild, record D-175.

A, B. Purple mica. Compact sericitic mineral associated with albite and topaz.

C, D. Alteration product of topaz.

E. Sericite (metasericite) apparently an alteration product of oligoclase; Be, spectrographic tests by George Steiger.

F. From Pend Oreille district, Idaho, associated with pyrite, molybdenite, and gouge in a seam of contact-metamorphic minerals in granodiorite. Sample purified by Edward Sampson. Analysis by J. G. Fairchild, record C-418.

G. From Climax district, Colo., collected by J. W. Vanderwilt. Analysis by J. G. Fairchild, record D-6.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	46.81	46.80	48.06	47.22	49.16	50.26	49.14
Al <sub>2</sub> O <sub>3</sub> .....	36.09	35.84	32.14	32.00	30.81	32.12	32.27
Fe as Fe <sub>2</sub> O <sub>3</sub> .....	.28	.27	1.24	1.33	1.53	.88	1.16
TiO <sub>2</sub> .....	.01	.01	.....	.....	.04	.24	.02
MgO.....	.62	.56	1.39	1.25	2.22	.77	1.81
CaO.....	.29	.29	Trace	Trace	.15	None	.80
Na <sub>2</sub> O.....	.68	.60	.17	None	.48	None	.23
K <sub>2</sub> O.....	10.24	10.08	9.21*	8.89	10.90	10.04	10.88
H <sub>2</sub> O.....	.42	.64	2.06	3.14	.15	.26	4.42
H <sub>2</sub> O+.....	5.00	5.05	5.46	5.64	4.73	4.69	
P <sub>2</sub> O <sub>5</sub> .....	.....	.....	Trace	.12	.....	.....	.04
MnO.....	.....	.....	.20	.14	.....	.....	.....
F, Li.....	.....	.....	None	None	.....	None	.....
Be.....	.....	.....	None	Present	.....	.....	.....
S.....	.....	.....	.....	.....	.....	.06	.....
	100.44	100.14	99.93	99.73	100.17	99.31	100.71



## SERPENTINE

(See also Antigorite.)

Serpentine of the picrolite type from Bellows Falls, Vt., submitted by C. S. Ross. Analysis by J. G. Fairchild, record C-993.

SiO <sub>2</sub> .....	39.92	CaO.....	None
Al <sub>2</sub> O <sub>3</sub> .....	.44	H <sub>2</sub> O+.....	13.80
Fe <sub>2</sub> O <sub>3</sub> .....	5.68	TiO <sub>2</sub> .....	None
FeO.....	Trace		
MgO.....	39.10		98.94

## SHATTUCKITE

From Shattuck Arizona mine, Bisbee, Ariz. Analyses by W. T. Schaller, records 2928 and 2926.

A. From heavy solution.

B. Deep-blue spherulites.

C. Pale-blue massive mixture of shattuckite and plancheite.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	39.68	37.91	39.92	H <sub>2</sub> O.....	5.94	5.83	6.41
CuO.....	54.80	55.51	53.20	ZnO.....	Trace		
FeO.....	.15	.43	.83				
CaO.....	.05		None		100.63	99.68	100.36

## SPADAITE

A, B. From Cane Springs mine, Gold Hill, Tooele County, Utah, collected by T. B. Nolan. Analysis by W. T. Schaller, record C-1057. Described in Am. Mineralogist, vol. 16, pp. 231-236, 1931. A, Material as analyzed; B, recalculated after deducting insoluble, wollastonite, and H<sub>2</sub>O at 110° C.

C. Nickeliferous spadaite or a related nickel-magnesium silicate from Webster, N. C. Similar material has been described as genthite, garnierite, and nickeliferous deweylite. Specimen collected by J. T. Pardee. Analysis by Charles Milton, record D-300. Optically it consists of a crystallized gel, brown spherulites, of fairly high birefringence, and index about 1.46. The analysis approximates RO.SiO<sub>2</sub>.H<sub>2</sub>O.

	A	B	C		A	B	C
Insoluble residue.....	8.68			MgO.....	24.72	31.81	15.5
SiO <sub>2</sub> .....	43.69	54.05	50.0	NiO.....			16.5
Fe <sub>2</sub> O <sub>3</sub> .....	.22	.30	4.8	H <sub>2</sub> O.....	20.87	13.52	12.1
FeO.....	.27	.35					
CaO.....	1.58				100.03	100.03	98.9

## TALC

A-D. Samples collected and studied by J. S. Diller. Analyses by J. G. Fairchild, record C-177.

A. Indian talc, believed to come from Sandun, about 275 miles northwest of Madras, showing some chlorite.

B. German talc, believed to be from southern Fichtelgebirge, Bavaria. Very little chlorite.

C. Italian talc. Some pale-green chloritic material.

D. French talc, said to be from Luzenac. A little chloritic material.

E, F. White talc from Riggs, Calif. Analyses by R. C. Wells, record 2874.

G. From Dublin, Harford County, Md. Analysis by J. G. Fairchild, record 3256.

	A	B	C	D	E	F	G
SiO <sub>2</sub> .....	61.00	61.37	61.52	61.44	60.88	63.36	58.68
Al <sub>2</sub> O <sub>3</sub> .....	2.12	1.96	.84	1.52	.36	.46	3.75
Fe <sub>2</sub> O <sub>3</sub> .....	None	None	None	None	.10	.09	
FeO.....	1.74	1.47	1.27	.97	.33	.30	5.52
MgO.....	29.83	30.23	31.38	31.55	28.85	27.60	26.80
CaO.....	None	None	None	None	4.28	3.49	None
H <sub>2</sub> O.....	5.56	5.37	5.42	5.19	4.50	3.92	5.33
	100.25	100.40	100.43	100.67	99.30	99.22	100.08



## TOPAZ

From Old Einstein silver mine, 9 miles west of Fredericktown, Madison County, Mo. Collected by C. S. Ross. Partial analysis by E. P. Henderson, record C-658.

SiO <sub>2</sub> .....	32.65
Al <sub>2</sub> O <sub>3</sub> .....	54.67
Fe <sub>2</sub> O <sub>3</sub> .....	1.78
F.....	Present

## TOURMALINE

From a vein northeast of Gold Hill mine, Quartzburg, Boise County, Idaho. Submitted by Louis Klein, of Boise. Partial analysis by W. T. Schaller, record C-749.

SiO <sub>2</sub> .....	37.14
Al <sub>2</sub> O <sub>3</sub> .....	35.02
FeO.....	1.93
CaO.....	.10
MgO.....	8.89

## URANOPHANE

From Lusk, Wyo., collected by F. L. Hess. Analysis by W. T. Schaller, record C-495-c. A, as received; B, with impurities deducted.

	A	B		A	B
UO <sub>2</sub> .....	45.5	67.2	Quartz.....	2.1	.....
CaO.....	20.9	6.5			
SiO <sub>2</sub> .....	9.4	13.9		100.1	100.2
H <sub>2</sub> O+CO <sub>2</sub> .....	22.2	12.6			

<sup>1</sup> H<sub>2</sub>O.

## ZINNWALDITE

From Morefield mine, Amelia County, Va., collected and purified by J. J. Glass. Analysis by J. J. Fahey. Determination of cesium by R. E. Stevens, remaining alkalis by R. C. Wells, record D-318.

SiO <sub>2</sub> .....	43.70	H <sub>2</sub> O-.....	0.08	Cs <sub>2</sub> O.....	0.10
Al <sub>2</sub> O <sub>3</sub> .....	22.96	H <sub>2</sub> O+.....	1.35	F.....	5.52
Fe <sub>2</sub> O <sub>3</sub> .....	.59	TiO <sub>2</sub> .....	.32		
FeO.....	11.67	Li <sub>2</sub> O.....	1.92		101.58
MgO.....	.03	Na <sub>2</sub> O.....	.74	Less O.....	2.32
CaO.....	.02	K <sub>2</sub> O.....	9.58		
MnO.....	1.96	Rb <sub>2</sub> O.....	1.04		99.26

## TITANATES

## BRANNERITE

From Stanley Basin, Idaho, submitted by F. L. Hess. Analysis by R. C. Wells, record D-252. Described in Franklin Inst. Jour., vol. 189, p. 225, 1920. Calculated age about 37 million years.

SiO <sub>2</sub> .....	0.6	Ce <sub>2</sub> O <sub>3</sub> .....	None	CO <sub>2</sub> .....	0.2
TiO <sub>2</sub> .....	39.0	Y <sub>2</sub> O <sub>3</sub> .....	3.9	Fe <sub>2</sub> O <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub> , P <sub>2</sub> O <sub>5</sub> .....	Traces
FeO.....	2.9	ZrO <sub>2</sub> .....	.2		
CaO.....	2.9	BaO.....	.3		100.0
UO <sub>2</sub> .....	10.3	SrO.....	.1		
UO <sub>3</sub> .....	33.5	H <sub>2</sub> O.....	2.0	Specific gravi ty.....	5.42
ThO <sub>2</sub> .....	4.1				

<sup>1</sup> Average molecular weight 350.

## COLUMBATES, TANTALATES

## COLUMBITE

Two analyses of material from the collection of F. W. Clarke, locality unknown but probably Middletown, Conn.

A. Analysis by R. C. Wells, record C-285.

B. Analysis by J. G. Fairchild, record D-85.



	A	B		A	B
Insoluble.....		2.25	NiO, CoO.....	Traces	-----
Cb <sub>2</sub> O <sub>3</sub> .....	66.0	61.38	SnO <sub>2</sub> .....	None	-----
Ta <sub>2</sub> O <sub>5</sub> .....	13.1	16.03	H <sub>2</sub> O.....		Trace
SiO <sub>2</sub> .....	.9	-----	TiO <sub>2</sub> .....	None	0.50
FeO.....	12.7	12.50			
MgO.....	.2	-----		100.3	99.11
CaO.....	.1	-----			
MnO.....	7.3	6.45	Specific gravity.....	5.63	5.63

## MICROLITE

From locality 2 miles southwest of Ohio City, Colo., found in 1932 by E. B. Eckel. Material purified further by J. J. Glass. Analysis made for T. S. Lovering by J. G. Fairchild, record D-332. Calculated age, 765 million years.

Insoluble+SiO <sub>2</sub> .....	0.92	F.....	1.51	As <sub>2</sub> O <sub>3</sub> .....	Trace
Al <sub>2</sub> O <sub>3</sub> .....	.10	MnO.....	.11	BeO.....	None
Fe <sub>2</sub> O <sub>3</sub> .....	1.91	Ta <sub>2</sub> O <sub>5</sub> .....	68.47	PbO.....	0.40
MgO.....	.04	Cb <sub>2</sub> O <sub>3</sub> .....	4.48		
CaO.....	9.19	SnO <sub>2</sub> .....	.95		98.41
Na <sub>2</sub> O.....	2.94	UO <sub>2</sub> .....	1.69	Less O=F.....	.64
K <sub>2</sub> O.....	.25	UO <sub>3</sub> .....	2.40		
H <sub>2</sub> O.....	2.84	ThO <sub>2</sub> + rare earths.....	None		97.77
TiO <sub>2</sub> .....	.10	ZnO.....	None		
P <sub>2</sub> O <sub>5</sub> .....	None	CuO.....	.04	Specific gravity.....	5.604
Cl.....	None	Bi <sub>2</sub> O <sub>3</sub> .....	.07	Pb/U.....	.105

## POLYCRASE

From Brazil. Described by Hess and Henderson in Franklin Inst. Jour., vol. 200, p. 235, 1925. Analysis by E. P. Henderson, record C-533.

TiO <sub>2</sub> .....	34.88	Rare earths.....	29.28	U <sub>2</sub> O <sub>3</sub> .....	6.48
Cb <sub>2</sub> O <sub>3</sub> .....	20.31	Fe <sub>2</sub> O <sub>3</sub> .....	.78	H <sub>2</sub> O.....	2.04
Ta <sub>2</sub> O <sub>5</sub> .....	Trace	Al <sub>2</sub> O <sub>3</sub> .....	.44		
ThO <sub>2</sub> .....	5.22	PbO.....	.64		100.07

## SAMARSKITE

A, B. Analyses of two portions of a specimen selected according to their radioactivity from material from Petaca, N. Mex. Described by Hess and Wells in Am. Jour. Sci., 5th ser., vol. 19, p. 18, 1930. Analyses by R. C. Wells, record C-1065. A, More radioactive part; B, less radioactive part.

C. Specimen from collection of F. W. Clarke, locality unknown. Analysis by J. G. Fairchild, record D-84. The presence of silica was not definitely determined.

	A	B	C		A	B	C
Cb <sub>2</sub> O <sub>3</sub> .....	41.39	41.29	} 52.00	ZnO.....	0.04	0.05	Trace
Ta <sub>2</sub> O <sub>5</sub> .....	7.27	1.19		MgO.....			Trace
TiO <sub>2</sub> .....	4.29	1.38	2.33	CaO.....	4.22	2.98	1.01
SnO <sub>2</sub> .....	.02	.02		PbO.....	.43	.11	.53
UO <sub>2</sub> .....	4.85	1.88	} 10.16	Bi <sub>2</sub> O <sub>3</sub> .....	.02	.04	-----
UO <sub>3</sub> .....	7.67	3.84		H <sub>2</sub> O.....			1.02
ThO <sub>2</sub> .....	1.58	1.10	.80	Ignition.....	2.06	3.27	-----
CeO <sub>2</sub> .....	.51	.56	None	Undetermined.....	.27	1.03	.85
La <sub>2</sub> O <sub>3</sub> .....	Trace	Trace	-----				
(Y,Er) <sub>2</sub> O <sub>3</sub> .....	17.64	37.69	16.93		98.80	98.38	98.23
Fe <sub>2</sub> O <sub>3</sub> .....	5.85	1.36	12.22				
MnO.....	.89	.59	.38	Specific gravity.....	5.22	-----	5.49

D-F. Samarskite from the Spinelli quarry, 6 miles east of South Glastonbury, Conn. Received through Charles Palache. Purified by Harry Berman and C. M. Alter. Analysis by R. C. Wells, record D-430. Pb/U+0.36 Th=0.0388. Age by logarithmic formula 289 million years.

D, Smith's method; E, Fenner's method; F, Mean.



	D	E	F		D	E	F
SiO <sub>2</sub> .....	0.03	-----	0.03	MnO.....	1.75	-----	1.75
Cb <sub>2</sub> O <sub>5</sub> .....	42.00	-----	42.00	ZnO.....	None	-----	None
Ta <sub>2</sub> O <sub>5</sub> .....	14.73	-----	14.73	MgO.....	.02	-----	.02
TiO <sub>2</sub> .....	1.40	-----	1.40	CaO.....	.33	-----	.33
UO <sub>2</sub> .....	8.00	7.70	7.85=6.91 U	PbO.....	.30	{ 0.362 } { .340 }	.334=310 Pb
Ce <sub>2</sub> O <sub>3</sub> .....	.53	-----	.53	H <sub>2</sub> O.....	.06	-----	.06
(La,Tb) <sub>2</sub> O <sub>3</sub> , etc.	1.55	-----	1.55	H <sub>2</sub> O+.....	.59	-----	.59
Y <sub>2</sub> O <sub>3</sub> .....	12.47	-----	12.47	Undetermined.....	.46	-----	.46
ThO <sub>2</sub> .....	3.62	3.32	3.47=3.05 Th				
FeO.....	2.11	-----	2.11				
Fe <sub>2</sub> O <sub>3</sub> .....	9.82	-----	9.82		90.77	-----	99.504

## BORATES

## AMMONIOBORITE

From Larderello, Italy. Described by W. T. Schaller in *Am. Mineralogist*, vol. 18, pp. 480-492, 1933. Analysis by W. T. Schaller, record C-1074.

NH <sub>4</sub> .....	9.78
B <sub>2</sub> O <sub>3</sub> .....	74.18
H <sub>2</sub> O (by difference).....	16.04

## HYDROBORACITE

100.00

From Ryan, Calif. Collected by H. S. Gale. Analysis by W. T. Schaller, record C-316.

CaO.....	14.06	Fe <sub>2</sub> O <sub>3</sub> .....	0.12
MgO.....	10.14	SiO <sub>2</sub> .....	.23
B <sub>2</sub> O <sub>3</sub> .....	47.71	CO <sub>2</sub> .....	Trace
H <sub>2</sub> O.....	None		
H <sub>2</sub> O+.....	27.37		99.63

## KERNITE

From Kern County, Calif. Analysis by W. T. Schaller, record C-901. Described by Schaller in *Prof. Paper 158*, pp. 146-163, 1930.

A. As analyzed.

B, C. Comparison of the loss of water from octahedral borax, Na<sub>2</sub>O·2B<sub>2</sub>O<sub>3</sub>·5H<sub>2</sub>O, and ordinary borax, Na<sub>2</sub>O·2B<sub>2</sub>O<sub>3</sub>·10H<sub>2</sub>O, respectively, with that from kernite given under A.

	A	B	C		A	B	C
Insoluble.....	None	-----	-----	H <sub>2</sub> O at 110°-200°.....	9.08	10.82	5.08
Na <sub>2</sub> O.....	22.63	-----	-----	H <sub>2</sub> O at 200°+.....	6.45	5.31	3.91
CaO.....	None	-----	-----				
B <sub>2</sub> O <sub>3</sub> .....	50.76	-----	-----	Total H <sub>2</sub> O.....	99.89	-----	-----
H <sub>2</sub> O at -110°.....	10.97	16.03	38.47		26.50	32.16	47.46

## LUDWIGITE

From the Little Cottonwood district, Utah. A magnesium variety of ludwigite described by B. S. Butler and W. T. Schaller, *Washington Acad. Sci. Jour.*, vol. 7, p. 29, 1917. Analysis by W. T. Schaller, record D-232.

FeO.....	2.55	H <sub>2</sub> O.....	0.49
MgO.....	38.34	Insoluble.....	.61
Fe <sub>2</sub> O <sub>3</sub> .....	40.74		
B <sub>2</sub> O <sub>3</sub> .....	17.36		100.09

## PROBERTITE

From Kern County, Calif. Described as kramerite by W. T. Schaller in *Prof. Paper 158*, pp. 139-146, 1930. Analysis by W. T. Schaller, record C-977. Average of three analyses.

SiO <sub>2</sub> , soluble in HCl.....	0.57	B <sub>2</sub> O <sub>3</sub> <sup>1</sup> .....	49.35
Al <sub>2</sub> O <sub>3</sub> , soluble in HCl.....	.42	H <sub>2</sub> O (total).....	25.40
Insoluble in HCl.....	1.74		
Na <sub>2</sub> O.....	8.34		100.93
CaO.....	15.11		

<sup>1</sup> B<sub>2</sub>O<sub>3</sub> determination probably a little high, owing to the reactivity of the separated SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> from the residue (clay). Sample may have contained a little admixed borax.



## TINCALCONITE

From Kern County, Calif. Described by W. T. Schaller in Prof. Paper 158, pp. 163-164, 1930. Analyses by W. T. Schaller, record C-980.

A. Coating on kernite.

B. From seam in clay associated with kernite and borax.

	A	B		A	B
Insoluble in H <sub>2</sub> O.....	0.48	0.90	H <sub>2</sub> O.....	30.59	30.93
Na <sub>2</sub> O.....	20.80	20.72			
B <sub>2</sub> O <sub>3</sub> .....	47.52	47.19		99.39	99.74

## ULEXITE

From Kern County, Calif. Analysis by W. T. Schaller, record C-901. Described in Prof. Paper 158, pp. 138-139, 1930.

Na <sub>2</sub> O.....	7.09
CaO.....	14.06
B <sub>2</sub> O <sub>3</sub> .....	42.94
H <sub>2</sub> O.....	35.54
Insoluble.....	.10
	99.73

## NITRATES

## NITER

A, B. Efflorescent salts collected by G. R. Mansfield 10 miles west of Homedale, Idaho. Water-soluble part. Analyses by R. K. Bailey, record 2983.

	A	B		A	B		A	B
Cl.....	0.09	0.18	Na.....	31.13	13.74	Ca.....	1.61	1.77
SO <sub>4</sub> .....	19.39	4.62	K.....	.39	19.75			
NO <sub>3</sub> .....	47.25	59.91	Mg.....	.14	.03		100.00	100.00

C. Niter from Riley, Oreg. Analysis by R. K. Bailey, record 3047. Soluble, 27.55 percent. NO<sub>3</sub>=52.29 percent of soluble part.

## SODA NITER

From Confidence field, Inyo County, Calif. Collected by L. F. Noble and described in Bull. 820, 1931. Analyses A and B by E. T. Erickson, record C-146, and R. K. Bailey, record C-260.

A-B. Best hand-picked specimens.

C. Composition of soluble salts (43.12 percent of sample).

Occurrences of nitrates in the United States are summarized in Bull. 838 by G. R. Mansfield. Many chemical tests have been made, but the percentage of nitrate in average samples is generally too low to have any commercial importance.

	A	B	C		A	B	C
Na.....	6.00	6.01	33.30	BO <sub>3</sub> .....			0.65
K.....			.51	NO <sub>3</sub> .....	22.18	22.21	23.19
Mg.....			.23	ClO <sub>3</sub> .....			Trace
Ca.....			.70	NH <sub>4</sub> , IO <sub>3</sub> , I.....			None
Cl.....			35.34				
SO <sub>4</sub> .....			6.08				100.00

## PHOSPHATES AND ARSENATES

## ALUMINUM PHOSPHATE

From Tacubaya, Mexico. Analysis by J. G. Fairchild, record C-654. Does not appear to be any known mineral. A little Na<sub>2</sub>O is also present.

Al <sub>2</sub> O <sub>3</sub> .....	17.74	(NH <sub>4</sub> ) <sub>2</sub> O.....	3.96	H <sub>2</sub> O (ignition).....	32.63
Fe <sub>2</sub> O <sub>3</sub> .....	.89	P <sub>2</sub> O <sub>5</sub> .....	33.07	Insoluble.....	.80
MgO.....	.30	SO <sub>3</sub> .....	1.74		
CaO.....	.44	N <sub>2</sub> O <sub>5</sub> .....	4.69		98.97
K <sub>2</sub> O.....	2.71				



## ARSENIOSIDERITE

A. From Romanèche, France.

B. Material collected by B. N. Moore at the Gallinger-Root mines, 2 miles northwest of Ludlow, San Bernardino County, Calif. Both analyses by Charles Milton, record D-452. The small sample of B available contained a little psilomelane, hematite, and siliceous impurities.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	3.07	<sup>1</sup> 18.59	MgO.....	0.17	-----	H <sub>2</sub> O-.....	0.30	0.53
Fe <sub>2</sub> O <sub>3</sub> .....	36.45	27.03	MnO.....	Trace	0.84	H <sub>2</sub> O+.....	8.06	8.45
Al <sub>2</sub> O <sub>3</sub> .....	Trace	2.41	As <sub>2</sub> O <sub>3</sub> .....	37.65	31.16			
CaO.....	14.14	11.93	P <sub>2</sub> O <sub>5</sub> .....	.18	-----		100.02	100.94

<sup>1</sup> Includes insoluble.

## AUTUNITE

From fault block on southeast side of Temple Mountain, Utah. Submitted by F. L. Hess. Analyses by W. T. Schaller, record C-314-a.

A. Impure material as analyzed.

B. Recalculated with impurities deducted.

	A	B		A	B		A	B
UO <sub>3</sub> .....	21.11	63.01	H <sub>2</sub> O.....	7.07	21.11	Insoluble.....	64.22	-----
CaO.....	2.14	6.39	Se.....	Trace	-----			
P <sub>2</sub> O <sub>5</sub> .....	3.18	9.49	SO <sub>3</sub> .....	Trace	-----		97.72	100.00

## CRANDALLITE

From Tintic district, Utah. Analysis of impure material by W. T. Schaller record 3074.

Insoluble.....	35.13	MgO.....	0.61	SO <sub>3</sub> .....	2.47
Al <sub>2</sub> O <sub>3</sub> .....	25.16	H <sub>2</sub> O-.....	.84	P <sub>2</sub> O <sub>5</sub> .....	17.61
SrO.....	1.44	H <sub>2</sub> O+.....	12.26		
CaO.....	4.88				100.40

## FERROUS PHOSPHATE

An unclassified iron phosphate, collected by F. W. Horton at Climax mica mine, near Custer, S. Dak. Analysis by E. P. Henderson, record C-1064.

Insoluble.....	0.97	K <sub>2</sub> O.....	2.01	H <sub>2</sub> O.....	1.11
MgO.....	1.87	Na <sub>2</sub> O.....	6.42	F.....	Present
CaO.....	4.15	Al <sub>2</sub> O <sub>3</sub> .....	2.03		
MnO.....	3.31	Fe <sub>2</sub> O <sub>3</sub> .....	1.50		100.06
FeO.....	36.87	P <sub>2</sub> O <sub>5</sub> .....	39.82		

## METATORBERNITE

From southeast end of block fault running through Temple Mountain, Utah. Collected by F. L. Hess and described in Bull. 750, p. 70, 1925. Analysis by W. T. Schaller, record C-314-a. A, As received; B, with impurities deducted.

	A	B		A	B		A	B
UO <sub>3</sub> .....	35.86	55.82	As <sub>2</sub> O <sub>3</sub> .....	0.13	0.20	Insoluble.....	35.76	-----
CaO.....	.05	.08	H <sub>2</sub> O.....	11.08	17.25			
P <sub>2</sub> O <sub>5</sub> .....	[11.16]	17.37	CuO.....	5.96	9.28		100.00	100.00

## PHOSPHORITE

Although a large number of analyses of phosphate rock have been made in the Survey laboratory, most of them were restricted to the determination of P<sub>2</sub>O<sub>5</sub> only. Those given below are also very incomplete, but they involve some additional constituents. A-F, collected by G. R. Mansfield, G-I by J. T. Pardee. Analyses by J. G. Fairchild, record C-564, C-577, C-579, and C-923, except E and F by R. K. Bailey, record C-220.

A. From Paradise Valley, Idaho, SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 22, T. 2 S., R. 39 E.B. Same, NW $\frac{1}{4}$  sec. 17, T. 2 S., R. 39 E.



- C. Ammon quadrangle, Idaho, NE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 17, T. 2 S., R. 39 E.  
 D. Portneuf quadrangle, Idaho, T. 6 S., R. 39 E.  
 E. Montpelier Canyon, Idaho.  
 F. Paris Canyon, Idaho.  
 G. Indian Creek, Madison Range, Montana.  
 H. Shaly phosphate, Huntsville, Utah.  
 I. Duff Hill, Philipsburg, Mont.

	A	B	C	D	E	F	G	H	I
Insoluble.....							6.34	12.27	
(Al, Fe) <sub>2</sub> O <sub>3</sub> .....	1.84	1.70	0.72	0.68			1.67	3.92	4.95
V <sub>2</sub> O <sub>5</sub> .....	None	None	None	.41	0.32	0.21			
F.....	1.57	1.00	1.32	.04	.42	.91			
Cr <sub>2</sub> O <sub>3</sub> .....				.06	.23	.18			
P <sub>2</sub> O <sub>5</sub> .....	37.15	20.45	27.56	31.98	31.73	32.76	32.26	31.38	29.02
Ca <sub>3</sub> P <sub>2</sub> O <sub>8</sub> (calculated).....	81.10	44.65	60.20	69.80	69.37	71.52	70.45	68.54	63.35

## TRIPLITE

A. Collected in the Black Hills, S. Dak., by F. L. Hess. Analysis by E. P. Henderson, record C-785.

B. From Sierra de Zapata, Catamarca Province, Argentina. Hand-picked dark-brown material. Analysis by E. P. Henderson, record C-949.

	A	B		A	B
SiO <sub>2</sub> .....	1.16	0.28	Na <sub>2</sub> O.....	0.96	0.27
MnO.....	37.27	34.84	K <sub>2</sub> O.....	.36	.33
FeO.....	15.74	23.54	As <sub>2</sub> O <sub>3</sub> , V <sub>2</sub> O <sub>5</sub> , Al <sub>2</sub> O <sub>3</sub> .....	None	None
Fe <sub>2</sub> O <sub>3</sub> .....	5.55		Li <sub>2</sub> O, Zn, SO <sub>3</sub> .....		
P <sub>2</sub> O <sub>5</sub> .....	31.27	31.50			
H <sub>2</sub> O.....	1.24	1.58		102.44	102.23
F.....	7.10	6.41	Less O for F and Cl.....	3.02	2.69
Cl.....	.19	Trace			
CaO.....	1.60	3.48		99.42	99.54
MgO.....	Trace	Trace			

## VARISCITE

From Lucin, Utah. Analysis by W. T. Schaller, record D-362. Originally described as lucinite in Bull. 610, 1916. Metavariscite is a dimorphic form of variscite. A, As analyzed; B, with quartz deducted.

	A	B		A	B
Al <sub>2</sub> O <sub>3</sub> .....	25.82	34.97	SiO <sub>2</sub> .....	26.29	
P <sub>2</sub> O <sub>5</sub> .....	31.56	42.75			
H <sub>2</sub> O.....	16.80	22.75		100.47	100.47

## VANADATES

## FERNANDINITE

Collected at Minasragra, Peru, by D. F. Hewett. Analysis with description by W. T. Schaller in Washington Acad. Sci. Jour., vol. 5, p. 7, 1915. Record 2948.

Insoluble in acid.....	12.18	MgO.....	0.06
V <sub>2</sub> O <sub>4</sub> .....	10.18	K <sub>2</sub> O.....	.52
V <sub>2</sub> O <sub>5</sub> .....	55.42	H <sub>2</sub> O.....	15.81
MoO <sub>3</sub> .....	1.38		
Fe <sub>2</sub> O <sub>3</sub> .....	.79		99.69
CaO.....	3.35		

## HEWETTITE

From Minasragra, Peru. Collected by D. F. Hewett. Analysis by W. T. Schaller, record C-315.

V <sub>2</sub> O <sub>4</sub> .....	0.43	MoO <sub>3</sub> .....	0.99
V <sub>2</sub> O <sub>5</sub> .....	71.20		
CaO.....	7.15		100.81
H <sub>2</sub> O.....	21.04		



## MELANOVANADITE

From Minasragra, Peru. Collected by D. F. Hewett. Analyses by W. T. Schaller, record C-315.

- A. Melanovanadite.  
B. Alteration product, largely  $V_2O_5 \cdot 2H_2O$ .  
C. Matrix of alteration product.

	A	B	C		A	B	C
$V_2O_5$ .....	34.1	7.8	13.34	$MoO_3$ .....			1.58
$V_2O_5$ .....	40.7	73.5	12.13	Insoluble.....	1.3	1.7	54.69
$CaO$ .....	11.4	3.3	2.35				
$H_2O$ -.....	8.9	9.0	9.71		103.4	103.3	93.80
$H_2O$ +.....	7.0	8.0					

## MOTTRAMITE

From Higgins mine, Bisbee, Ariz. Described as psittacinite by Taber and Schaller in Am. Mineralogist, vol. 15, pp. 575-579, 1930. Analysis by W. T. Schaller, record C-1075.

$CuO$ .....	19.10	Manganese oxide.....	3.06
$ZnO$ .....	None	Ignition loss.....	4.79
$PbO$ .....	150.13		
$V_2O_5$ .....	21.11		98.19

<sup>1</sup> Probably low

## PASCOITE

From Crescent no. 3 claim, Crescent Creek, Henry Mountains, Utah. Analysis by W. T. Schaller, record 2945.

- A. As analyzed.  
B. Soluble portion.  
C. Reduced, gypsum rejected.

	A	B	C		A	B	C
Soluble in $H_2O$ .....	9.35			$V_2O_5$ .....		37.1	65.3
Insoluble.....	90.60			$H_2O$ .....			23.1
$CaO$ .....		17.7	11.6				
$SO_3$ .....		13.7			99.95	68.5	100.0

## RAUVITE

From Temple Mountain, Emery County, Utah. Collected by F. L. Hess and described in Bull. 750, pp. 68-70, 1935. Analyses by W. T. Schaller, record C-314-a. A, as received; B, with impurities deducted.

	A	B		A	B		A	B
$UO_3$ .....	20.82	27.92	$As_2O_3$ .....	Trace		$MgO$ .....	0.12	
$V_2O_5$ .....	2.05	2.75	$Fe_2O_3$ .....	2.39		$SO_3$ .....	.13	
$V_2O_5$ .....	36.33	48.70	$H_2O$ -.....	7.77	10.42	Insoluble.....	24.06	
$CaO$ .....	2.00	2.68	$H_2O$ +.....	5.61	7.53			
$K_2O$ .....	Trace		Se.....	Trace			101.28	100.00

## SINCOSITE

From Sincos, Peru. Collected by W. S. Hutchinson, Boston. Analyses by W. T. Schaller, record C-317. See also Washington Acad. Sci. Jour., vol. 12, p. 195, 1922.

- A. Green rectangular plates.  
B. Selected crystals.  
C. Nodules consisting of 45 percent sincosite, 5 percent gypsum, about 22 percent volatile hydrocarbon, 5 percent water, and 23 percent ash.



	A	B	C		A	B	C
V <sub>2</sub> O <sub>5</sub> .....	36.3	37.8	15.67	Insoluble.....	0.3	0.7	22.86
V <sub>2</sub> O <sub>3</sub> .....			.33	Ignition.....			12.86
CaO.....	12.1	13.3	8.81	SO <sub>3</sub> .....			2.23
P <sub>2</sub> O <sub>5</sub> .....	31.7	31.1	14.72				
H <sub>2</sub> O.....	19.9	17.1	14.51		100.3	100.0	100.90

## UVANITE

Sample from San Rafael Swell, Utah. Described by Hess and Schaller in Washington Acad. Sci. Jour., vol. 4, p. 576, 1914. Analyses by W. T. Schaller, record 2950. A, impure; B, A reduced; C, picked material.

	A	B	C		A	B	C
Gangue.....	82.35		1.24	Fe <sub>2</sub> O <sub>3</sub> .....	0.18	1.02	
H <sub>2</sub> O.....	4.60	26.00	18.28	MgO.....			0.04
V <sub>2</sub> O <sub>5</sub> .....	6.76	38.21	37.70	CaO.....	.22	1.25	1.73
P <sub>2</sub> O <sub>5</sub> .....	.07	.39	.06	K <sub>2</sub> O.....	.10	.57	.30
As <sub>2</sub> O <sub>3</sub> .....	.02	.11	.65				
UO <sub>3</sub> .....	5.74	32.45	39.60		100.04	100.00	99.00

## ARSENATES

## ARSENOBISMITE

An impure sample from the Mammoth mine, Tintic district, Utah, described by A. H. Means in Am. Jour. Sci., 4th ser., vol. 41, p. 125, 1916. Analysis by R. C. Wells, record 3009. After allowing for admixtures the mineral is calculated to be 2Bi<sub>2</sub>O<sub>3</sub>·As<sub>2</sub>O<sub>5</sub>·2H<sub>2</sub>O.

Insoluble in HCl:		Soluble in HCl—Con.		Soluble in HCl—Con.	
SO <sub>3</sub> .....	16.60	Al <sub>2</sub> O <sub>3</sub> .....	0.44	P <sub>2</sub> O <sub>5</sub> .....	0.04
BaO.....	31.90	CuO.....	.12	Sb <sub>2</sub> O <sub>3</sub> .....	1.26
SiO <sub>2</sub> .....	1.42	CaO.....	.62	PbO.....	1.12
Soluble in HCl:		MgO.....	Trace		
Bi <sub>2</sub> O <sub>3</sub> .....	28.17	SO <sub>3</sub> .....	.46		99.14
As <sub>2</sub> O <sub>5</sub> .....	10.59	H <sub>2</sub> O.....	1.09		
Fe <sub>2</sub> O <sub>3</sub> .....	3.88	H <sub>2</sub> O+.....	1.43		

## SULPHATES

## ALUNOGEN

From Pintado Canyon, N. Mex. Collected by E. S. Larsen. Analysis by George Steiger, record 3133.

Al <sub>2</sub> O <sub>3</sub> .....	16.59
SO <sub>3</sub> .....	37.74
H <sub>2</sub> O.....	44.64
Insoluble.....	.94
	99.91

## ANHYDRITE

Banded material from Caesar Grandi well 1, Eddy County, N. Mex., collected by W. B. Lang. Analysis by E. T. Erickson, record D-223. The nature of the organic matter could not be definitely determined.

CaO.....	42.64	Carbonaceous matter.....	0.17
MgO.....	.02	Ignited insoluble in acid.....	.28
SO <sub>3</sub> .....	51.52	R <sub>2</sub> O <sub>3</sub> .....	.03
CO <sub>2</sub> .....	5.15		
Organic matter soluble in chloroform.....	.05		99.86

## APHTHALITE

Separated by F. C. Calkins from core, Government test 22, southeast corner sec. 26, T. 23 S., R. 30 E., Eddy County, N. Mex. Depth 1,449 feet. Analysis by J. J. Fahey, record D-109.

Insoluble in H <sub>2</sub> O.....	0.06
NaCl (computed from Cl).....	2.16
SO <sub>3</sub> .....	46.35
K <sub>2</sub> O.....	40.89
Na <sub>2</sub> O.....	10.42
	99.88



## ARGENTOJAROSITE

From Tintic Standard mine at Dividend, Utah, submitted by V. C. Heikes. Analysis by W. T. Schaller, record C-486. A, yellow-brown; B, brown.

	A	B		A	B		A	B
Ag <sub>2</sub> O.....	<sup>1</sup> 17.96	<sup>2</sup> 18.00	Al <sub>2</sub> O <sub>3</sub> .....	0.47	None	Insoluble.....	0.29	0.29
K <sub>2</sub> O.....	.51	.42	SO <sub>2</sub> .....	<sup>3</sup> 27.75	<sup>4</sup> 28.15			
Na <sub>2</sub> O.....	Trace	Trace	H <sub>2</sub> O+.....	9.87	9.81	Density.....	99.90	100.35
PbO.....	.79	.61	H <sub>2</sub> O-.....	None	None			
Fe <sub>2</sub> O <sub>3</sub> .....	42.26	43.07	P <sub>2</sub> O <sub>5</sub> .....	None	None		3.64	3.66

<sup>1</sup> Average of 17.94, 18.06, 17.87.

<sup>2</sup> Average of 18.31, 17.83, 17.86.

<sup>3</sup> Average of 7 determinations.

<sup>4</sup> Average of 5 determinations.

## BARITE

A. From Castle Islands, Duncan Canal, Alaska. Analysis by W. C. Wheeler, record 2881. Zinc present but not determined.

B. Collected by Theodore Chapin at Lime Point, Prince of Wales Island, Alaska. Analysis by George Steiger, record 3082.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	5.05	0.42	BaO.....	58.60	64.94	SO <sub>2</sub> .....	34.74	34.01
Fe <sub>2</sub> O <sub>3</sub> .....	.77	.12	PbO.....	.15	---			
CaO.....	Trace	None	Ignition.....	---	.19	MnO.....	99.68	99.84
SrO.....	.37	.06	MnO.....	Trace	---			
MgO.....	Trace	.16	TiO <sub>2</sub> .....	None	---			

## CELESTITE

A. Concentrate from Lead Hill mine, Saline Creek, Utah. Analysis for G. F. Loughlin by R. C. Wells, record 3095.

B. Near LaConner, Skagit County, Wash. Determinations by A. A. Chambers, record 3094.

C. Limestone partly replaced by celestite, Barstow, Calif. Analysis by R. C. Wells, record 3180. Described by Adolph Knopf in Bull. 660, pp. 260-261, 1918.

D-E. Average rock samples from locality 15 miles southwest of Aguila, Ariz., collected by B. S. Butler. Partial analysis by J. G. Fairchild, record C-1050. D, best rock; E, sample from 64 inches in five beds ranging from 7 to 20 inches in thickness in 8 feet of rock.

F. From Cady Range, near Argos, Calif., collected by B. N. Moore. Analysis by Charles Milton, record D-323.

	A	B	C	D	E	F
SiO <sub>2</sub> .....	6.9	---	---	12.91	22.10	1.53
Al <sub>2</sub> O <sub>3</sub> .....	.6	---	---	None	---	.92
Fe <sub>2</sub> O <sub>3</sub> .....	.3	---	---	.39	---	.54
FeO.....	.3	---	---	---	---	---
MgO.....	---	---	---	None	---	.11
CaO.....	.9	---	39.5	.41	.29	.97
H <sub>2</sub> O.....	.3	---	---	---	---	.56
TiO <sub>2</sub> .....	1.0	---	---	---	---	---
CO <sub>2</sub> .....	1.9	---	---	.57	---	.30
SO <sub>2</sub> .....	34.8	42.23	---	36.70	---	41.08
MnO.....	Trace	---	---	---	---	Trace
BaO.....	None	---	---	None	.33	1.07
SrO.....	45.8	54.80	12.9	48.10	41.26	52.35
PbO.....	6.6	---	---	---	---	---
	99.4	97.03	---	99.08	---	99.43



## GYPSUM

A. From 60-foot bed near top of Minnelusa sandstone, Sundance Canyon near Rocky Ford, Wyo., collected by W. W. Rubey. Analysis by J. G. Fairchild, record C-941.

B-C. Two samples from Fish Creek Mountains, Imperial County, Calif., submitted by General Land Office. Analyses by J. G. Fairchild, record C-183. B, NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 29, T. 13 S., R. 9 E., San Bernardino meridian; C, SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 19, T. 13 S., R. 9 E. San Bernardino meridian.

D-G. Four samples from Big Horn Basin, Wyo. Analyses by W. C. Wheeler, record 3062.

H-I. Two samples from Panasoffkee, Fla., collected by R. W. Stone, described in Mineral Resources for 1918, pt. 2, pp. 293-296, 1921. Analyses by Chase Palmer, record C-139. H, Bear Island, 6 inches below surface; I, Soapstone Island, 2 feet below surface.

J. From Muddy Creek, Nev., collected by W. W. Rubey. Analysis by Charles Milton, record D-320.

K. From east slope of Big Horn Mountains, Wyo., T. 47 N., R. 83 W., collected by D. D. Condit. Analysis by A. A. Chambers, record 3088.

	A	B	C	D	E	F	G	H	I	J	K
Insoluble.....	0.24									0.2	
SiO <sub>2</sub> .....				0.01	0.05	0.06	0.25	0.55	0.26		0.07
Al <sub>2</sub> O <sub>3</sub> .....				.17	.03	.05	.01	.52	.32	Trace	.11
Fe <sub>2</sub> O <sub>3</sub> .....	Trace	0.18	None								
MgO.....	.41	.27	0.12	.98	.44	.42	None				
CaO.....	32.72	32.54	32.48	33.74	32.92	32.72	34.20	32.39	32.30	32.8	32.81
H <sub>2</sub> O.....	20.20	20.00	20.44	19.50	19.99	20.03	20.00	21.64	21.53	20.8	20.40
CO <sub>2</sub> .....	1.18	.67	None								
SO <sub>4</sub> .....	45.33	44.35	45.42	43.92	45.74	45.18	45.50	44.10	45.00	44.9	45.42
Cl.....	Trace			None	None	None	None				
	100.08	98.01	98.46	98.32	99.17	98.46	99.96	99.20	99.41	98.7	98.81

<sup>1</sup> At 300°.

## HALOTRICHITE

A. Zinciferous specimen from 900-foot level of Tintic Standard mine, Dividend, Utah. Submitted by W. T. Schaller. Analysis of a small sample by Charles Milton, record D-361.

Insoluble in HCl.....	3.98	MnO.....	None	H <sub>2</sub> O-.....	26.21
Al <sub>2</sub> O <sub>3</sub> .....	10.61	CaO.....	0.34	H <sub>2</sub> O+.....	15.16
Fe <sub>2</sub> O <sub>3</sub> .....	.43	MgO.....	Trace		
FeO.....	6.67	PbO.....	.74		99.24
ZnO.....	1.65	SO <sub>4</sub> .....	33.45		

B. From Tonopah district, Nev., collected by T. B. Nolan. Analysis by Charles Milton, record D-150.

Fe <sub>2</sub> O <sub>3</sub> .....	13.84	BaO(?).....	0.84	Ash.....	0.20
Al <sub>2</sub> O <sub>3</sub> .....	3.08	MgO.....	.18		
FeO.....	.32	SO <sub>4</sub> .....	39.40		98.61
ZnO.....	1.50	H <sub>2</sub> O-.....	13.23		
MnO.....	7.00	H <sub>2</sub> O+.....	19.02		

## JAROSITE

A. Impure material collected by Adolph Knopf from Arabia district, Nev. Analysis by J. G. Fairchild, record C-435.

B. From Lion Hill, Chloride Point mine, Stockton quadrangle, Utah, collected by James Gilluly. Analysis by E. P. Henderson, record C-1058.

C. Artificial crystals made and analyzed by J. G. Fairchild, record D-205. Described in Am. Mineralogist, vol. 18, p: 544, 1933, with other jarosites.

	A	B	C		A	B	C
SiO <sub>2</sub> .....	1.7	1.43		SO <sub>4</sub> .....	20.9	33.15	32.1
Al <sub>2</sub> O <sub>3</sub> .....		4.01		P <sub>2</sub> O <sub>5</sub> .....	None		
Fe <sub>2</sub> O <sub>3</sub> .....	60.9	40.22	48.1				
Na <sub>2</sub> O.....		.90			99.3	100.12	100.0
K <sub>2</sub> O.....	6.0	9.16	9.5				
H <sub>2</sub> O-.....	.2	11.25	10.3				
H <sub>2</sub> O+.....	9.7						



## KORNELITE

From Tintic Standard mine, Dividend, Utah. Analysis by W. T. Schaller, record C-487.

Fe <sub>2</sub> O <sub>3</sub> .....	29.23
SO <sub>3</sub> .....	43.15
H <sub>2</sub> O.....	25.96
Insoluble.....	.86
Soluble residue.....	.62
	99.82

## LANGBEINITE

From McNutt well 1, sec. 4, T. 21 S., R. 30 E., Eddy County, N. Mex., depth 1,430 feet. Analysis by J. J. Fahey, record C-1032.

K <sub>2</sub> O.....	22.37	Loss on heating.....	0.25
Na <sub>2</sub> O.....	.48	Insoluble in H <sub>2</sub> O:	
MgO.....	19.15	Fe <sub>2</sub> O <sub>3</sub> .....	.02
SO <sub>3</sub> .....	57.44	Other insoluble matter.....	.03
Cl.....	None		
CaO.....	None		
			99.74

## LEONITE

From Joe W. Mitchell core, 1,368 feet 1 inch to 1,368 feet 3 inches, sec. 33, T. 20 S., R. 31 E., Eddy County, N. Mex. Analysis of impure material by E. P. Henderson, record C-1041. A, Material as analyzed; B, analysis recalculated after deducting 25.3 percent of kainite.

	A	B		A	B
K.....	3.97		H <sub>2</sub> O.....	19.18	18.59
K <sub>2</sub> O.....	18.95	25.74	Cl.....	3.61	
MgO.....	12.42	11.31			
SO <sub>3</sub> .....	40.80	44.36		99.74	100.00

## MELANTERITE

Copper-bearing melanterite from Rico district, Colo., collected by E. B. Eckel and described in *Am. Mineralogist*, vol. 18, p 449, 1933. Analysis of wet material by R. C. Wells, record D-146. The analysis calculates roughly to 2[FeSO<sub>4</sub>.7H<sub>2</sub>O].(Cu,Zn)SO<sub>4</sub>.7H<sub>2</sub>O.

FeSO <sub>4</sub> .7H <sub>2</sub> O.....	67.1
CuSO <sub>4</sub> .7H <sub>2</sub> O.....	24.9
ZnSO <sub>4</sub> .7H <sub>2</sub> O.....	4.2
Mg.....	None
Excess H <sub>2</sub> O (by difference).....	3.8
	100.00

## MINASRAGRITE

From Minasragra, Peru. Collected by D. F. Hewett. Analysis by W. T. Schaller, record 2947, with preliminary description in *Washington Acad. Sci. Jour.*, vol. 7, p. 501, 1917. A, as analyzed; B, minus impurities.

	A	B		A	B
Y <sub>2</sub> O <sub>3</sub> .....	5.29	24.64	Insoluble in H <sub>2</sub> O.....	66.16	
FeO.....	.97		H <sub>2</sub> O (by difference).....	14.28	42.19
NiO.....	1.92				
CaO.....	.46			100.00	100.00
SO <sub>3</sub> .....	10.92	33.17			

## MIRABILITE

Analyses by R. C. Wells, record C-912 and C-666.

A. From Lake 32, east of Soap Lake, east of Malott, Wash.

B. From lake south of Cody, Wyo., S½NE¼ sec. 14, T. 52 N., R. 102 W. Partly dried Glauber's salt.



	A	B		A	B
Insoluble.....	0.08	0.3	Fe, Ca, B.....	None	-----
H <sub>2</sub> O.....	50.90	49.5	Na <sub>2</sub> SO <sub>4</sub> .....	48.28	50.2
NaHCO <sub>3</sub> .....	.33	-----	Fe, Ca, Mg, Cl, CO <sub>2</sub> .....	-----	None
NaCl.....	.23	-----			
MgSO <sub>4</sub> .....	.18	-----		100.00	100.0

## PLUMBOJAROSITE

Two samples collected from Yellow Pine district, Nev., by Adolph Knopf. Described in Bulletin 620, pages 7-8, 11, 1916.

A. Analysis by R. C. Wells, record 3001, corrected in 1922. Specific gravity 3.458.

B. A bismuth-bearing variety. Analysis by R. C. Wells, record 2985.

	A	B		A	B		A	B
SiO <sub>2</sub> .....	1.14	6.90	H <sub>2</sub> O+.....	10.77	8.55	As <sub>2</sub> O <sub>5</sub> .....	-----	0.09
Al <sub>2</sub> O <sub>3</sub> .....	.80	.14	TiO <sub>2</sub> .....	-----	.37	Au.....	-----	.79
Fe <sub>2</sub> O <sub>3</sub> .....	38.90	32.24	CO <sub>2</sub> .....	-----	.43	PPd.....	-----	.22
MgO.....	.49	.14	P <sub>2</sub> O <sub>5</sub> .....	2.53	Trace	Pt.....	-----	.05
CaO.....	.45	.06	SO <sub>3</sub> .....	24.60	24.08	Ag.....	-----	Trace
Na <sub>2</sub> O.....	.76	.52	PbO.....	18.44	16.75			
K <sub>2</sub> O.....	.10	.22	CuO.....	-----	1.97		99.92	99.88
H <sub>2</sub> O-.....	.94	.02	Bi <sub>2</sub> O <sub>3</sub> .....	-----	6.34			

## POLYHALITE

A. From Bryant well of States Oil Corporation, 9 miles south of Midland, Tex., depth 2,305-2,425 feet, collected by D. D. Christner. Partial analysis by R. K. Bailey, record C-243.

B, C. From McDowell well, Glascock County, Tex., depth 1,000-1,400 feet. B, Brick red; C, salmon-colored. Collected by R. S. Sternbergh.

D. From Stassfurt, Germany. Analyses B-D by George Steiger, record 3287.

E. From Government test 17, depth 2,611 feet 6 inches, sec. 28, T. 20 S., R. 33 E., Lea County, N. Mex., submitted by W. B. Lang. Analysis by L. T. Richardson, record D-23.

	A	B	C	D	E
Insoluble.....	0.22	0.27	0.39	0.47	0.40
R <sub>2</sub> O <sub>3</sub> .....	.35	-----	-----	-----	-----
MgO.....	7.05	6.48	6.16	6.52	6.97
CaO.....	18.14	18.75	18.54	18.42	18.66
Na <sub>2</sub> O.....	2.06	None	.20	.09	-----
K <sub>2</sub> O.....	15.63	15.66	15.37	15.36	15.66
H <sub>2</sub> O.....	.35	6.07	6.50	6.43	6.39
SO <sub>3</sub> .....	-----	52.40	52.60	52.68	51.83
Cl.....	-----	None	None	.69	.11
		99.63	99.76	100.66	100.02

## SALINE CRUST

From a soda lake in sec. 14, T. 52 N., R. 102 W. sixth principal meridian, Wyoming, collected by J. D. Northrop. Analysis by J. G. Fairchild, record C-619. A, Analysis; B, hypothetical combinations.

A	B
Cl.....	1.02
SO <sub>4</sub> .....	55.56
Ca.....	2.89
Mg.....	2.25
Na.....	19.66
K.....	Trace
Loss on ignition.....	10.93
Insoluble.....	8.01
	100.32
NaCl.....	1.68
CaSO <sub>4</sub> .....	9.81
MgSO <sub>4</sub> .....	11.23
Na <sub>2</sub> SO <sub>4</sub> .....	58.66
K <sub>2</sub> SO <sub>4</sub> .....	Trace
H <sub>2</sub> O.....	10.93
Insoluble.....	8.01
	100.32



## SULPHOHALITE

From Searles Lake, Calif., described in Am. Jour. Sci., 4th ser., vol. 38, p. 273, 1914; see also idem, vol. 49, p. 76, 1920. Analysis by W. B. Hicks, record 2903.

SO <sub>3</sub> .....	42.00
Na <sub>2</sub> O.....	32.50
Na.....	11.35
Cl.....	9.19
F (by difference).....	4.96
	100.00

## SZOMOLNOKITE

From Tintic Standard mine, Dividend, Utah. Analysis by W. T. Schaller, record C-938.

FeO.....	38.94	SO <sub>3</sub> .....	45.77	Fe <sub>2</sub> O <sub>3</sub> .....	0.59
ZnO.....	1.18	P <sub>2</sub> O <sub>5</sub> .....	.27	Insoluble.....	2.66
CuO.....	.20	H <sub>2</sub> O.....	None		
PbO.....	.09	H <sub>2</sub> O+.....	10.45		100.15
(Mn, Mg)O.....	None				

## THENARDITE

A. Collected by D. G. Thompson near Buckhorn Springs, 6 miles south of Muroc, Kern County, Calif. Analysis by R. C. Wells, record C-266.

B. From alkali lake in secs. 22, 23, and 26, T. 25 N., R. 89 W., Carbon County, Wyo., submitted by H. I. Smith. Analysis by R. C. Wells, record D-9.

C. Composite sample submitted by Irvin Lavine from dry lake deposits of Divide County, N. Dak. Described in Am. Inst. Min. Met. Eng. Contr. 97, 1936. Analysis by R. C. Wells, record D-397.

	A	B	C		A	B	C
Insoluble.....	0.2	11.06	5.8	Na <sub>2</sub> CO <sub>3</sub> .....	1.5	None	-----
CaSO <sub>4</sub> .....	-----	-----	1.2	H <sub>2</sub> O.....	.3	0.49	3.7
MgSO <sub>4</sub> .....	-----	-----	1.6	Na <sub>2</sub> SO <sub>4</sub> .....	96.9	88.45	87.0
K <sub>2</sub> SO <sub>4</sub> .....	.3	-----	-----				
NaCl.....	.2	Trace	.9		100.0	100.00	100.2
NaHCO <sub>3</sub> .....	.6	None	-----				

## MOLYBDATES, TUNGSTATES, AND URANATES

## CUPROTUNGSTITE

From Cave Creek, Ariz. Analysis by W. T. Schaller, record 2929. See Am. Mineralogist, vol. 17, p. 234, 1932.

Reagent.....	Hard, compact material		Soft material		CaO.....	Hard, compact material		Soft material	
	HCl	HNO <sub>3</sub>	HCl	HNO <sub>3</sub>		.88	1.08	1.72	1.74
Unattacked.....	71.75	71.84	33.14	34.08	MgO.....	.20	.12	.19	.34
H <sub>2</sub> O (ignition).....	4.35	4.32	6.43	6.46	Fe <sub>2</sub> O <sub>3</sub> .....	.61	.68	1.52	1.03
WO <sub>3</sub> .....	13.10	13.24	35.47	35.26					
CuO.....	7.85	7.69	19.89	19.26		98.74	98.97	98.36	98.17

## GUMMITE

Small segregations resembling clarkeite or gummite, in serpentine, north of Easton, Pa., collected by R. C. Wells and C. S. Ross. Analyses by J. G. Fairchild, record D-145-a, made on 0.52 gram concentrated from about 15 pounds of rock. Age (calculated), 590 million years.

U <sub>3</sub> O <sub>8</sub> .....	42.70=36.21 U
ThO <sub>2</sub> .....	25.06=22.03 Th
CeO <sub>2</sub> , etc.....	5.10
PbO.....	3.86= 3.58 Pb
Insoluble.....	5.90



PITCHBLENDE

From Lusk, Wyo. Rather impure. Metallic copper mentioned as seemingly present. Occurrence described by Larsen, Hess, and Schaller, *Am. Mineralogist*, vol. 11, pp. 155-164, 1926. Analysis by W. T. Schaller, record C-495-a. Determination of lead made on a 1/2-gram sample and probably not very accurate.

Quartz, insoluble HCl.....	18.02	CaO.....	8.91	CO <sub>2</sub> .....	5.42
Cu, insoluble HCl.....	2.69	BaO.....	.15	H <sub>2</sub> O-.....	2.72
S, insoluble HCl.....	.71	MgO.....	.46	H <sub>2</sub> O+.....	5.54
SiO <sub>2</sub> , soluble.....	7.64	Fe <sub>2</sub> O <sub>3</sub> (total iron).....	.63	Zn, As.....	Trace
UO <sub>2</sub> .....	18.64	Al <sub>2</sub> O <sub>3</sub> .....	2.87	SO <sub>2</sub> , rare earths, V.....	None
UO <sub>3</sub> .....	17.06	K <sub>2</sub> O.....	.35		
CuO.....	7.23	Na <sub>2</sub> O.....	.69		
PbO.....	.23	P <sub>2</sub> O <sub>5</sub> .....	.45		100.41

THORIANITE

From Sherrer quarry, north of Easton, Pa., collected by G. W. Gehman. Average of two analyses by J. G. Fairchild, record D-154. Described in *Am. Jour. Sci.*, 5th ser., vol. 26, p. 45, 1933. Age (calculated), 790 million years.

UO <sub>2</sub> .....	4.44	R <sub>2</sub> O <sub>3</sub> .....	1.57	H <sub>2</sub> O.....	4.39
UO <sub>3</sub> .....	33.15	CaO.....	.97	Insoluble.....	7.86
ThO <sub>2</sub> .....	38.47	MgO.....	.53		
PbO.....	5.21	MnO.....	.31		
Rare earths.....	2.49				99.39

TYUYAMUNITE

From west side of Mount Hillers, Henry Mountains, Utah. Submitted by F. L. Hess and described in *Bull.* 750, pp. 73-78, 1925. Analysis by W. T. Schaller, record C-314-a. A, as received; B, with impurities deducted.

	A	B		A	B		A	B
UO <sub>2</sub> .....	52.22	57.68	BaO.....	0.26	0.29	H <sub>2</sub> O+.....	5.45	5.94
V <sub>2</sub> O <sub>5</sub> .....	17.62	19.46	Fe <sub>2</sub> O <sub>3</sub> .....	1.10	-----	Insoluble.....	8.51	-----
CaO.....	5.36	5.92	H <sub>2</sub> O-.....	9.34	10.18			
K <sub>2</sub> O.....	.47	.52					100.33	100.00

URANINITE

From Wilberforce, Cardiff Township, Ontario, Canada, submitted by A. C. Lane. Determination of lead-uranium ratio by R. C. Wells, record D-1. Calculated age, 1,125 million years.

Pb.....	9.26
U.....	53.52
Th.....	10.37
Pb.....	.61
U+0.38 Th	

ZIPPEITE

A specimen from Grand Wash, 2 miles southeast of Fruita, Wayne County, Utah, collected by F. L. Hess and described in *Bull.* 750, pp. 70-73, 1925. Analysis by W. T. Schaller, record C-314-a. A, as received; B, with gypsum and carbonates, phosphates, and arsenates of copper and calcium deducted.

	A	B		A	B
UO <sub>2</sub> .....	72.50	80.22	SO <sub>2</sub> .....	11.11	10.76
CaO.....	.97	-----	Insoluble.....	1.96	-----
P <sub>2</sub> O <sub>5</sub> , As <sub>2</sub> O <sub>3</sub> .....	3.73	-----			
H <sub>2</sub> O.....	8.77	9.02		100.00	100.00
CuO.....	.96	-----			



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