NOTES AND NEWS

SPECTROGRAPHIC DATA CONCERNING THE PRESENCE OF THE LESS COMMON ELEMENTS IN ROCKS

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During a period of a little more than a year, from May 1941 to June 1942, 425 miscellaneous samples of rocks were analyzed spectrographically by Laucks Laboratories, Inc. Since the samples were collected and submitted for paid analysis by persons not connected with the laboratories, more than a cursory megascopic classification was not possible and data concerning locality were so slight as to be of little value. However, the results obtained are interesting and may be of value to future research.

The instrument used for the analysis is an Applied Research grating spectrograph, the 2″ original grating being ruled with 48,000 lines, giving a dispersion of 7 Å per mm. in the first order and a resolving power of .1 Å at 2400 Å. The samples were prepared by grinding to about an 80 mesh size, mixing and cutting until approximately 5 grams were obtained, and further grinding to a −200 mesh size. Two portions of the −200 mesh sample were burned between carbon electrodes, using a 10 ampere current at 220 volts D.C. with the lower electrode positive. Ten mg. were mixed with an equal amount of carbon and completely volatilized and 30 mg. were arced for 15 seconds. Only a sampled portion of the light from the first burning reached the film while it was exposed continuously to the 15-second arcing to insure the detection of the more volatile elements. The resulting spectrograms, which included the region between 2360 Å and 4600 Å, were studied with the aid of an Applied Research projection comparator, enabling quick and thorough analyses.

No element was reported present in a sample unless its presence was definitely established. Conversely, failure to report an element meant that it was not present in quantities above the limits of detection.

Possible extraneous sources of impurities were studied to determine their contaminative value. Periodic analyses of the carbon electrodes show that they do not interfere, with the possible exception of faint Cu lines. The amount of Cu in the samples, however, is in nearly every case greater than the amount added by the electrodes. Contamination by the grinding apparatus is slight, being confined to an addition of a trace of Fe to the sample. Dust in the air is a possible source of error, but tests have shown this to be almost nonexistent.

Because of their abundance and common presence in the majority of rocks, Si, Ca, Mg, Al, Na, K, Fe are not listed in this study. All except

Na and K were found in every sample studied and the latter two were found in a majority of cases.

Table 1 gives data concerning the amounts of elements detectable, using the above procedure, in a silica base. The limits tend to vary with the base used, i.e. from rock to rock, however, the variation seems to be slight in most cases.

Spectrographic Data

Table 1. Table Showing Limits of Detection of the Elements Found in the Studied Samples, in a SiO_2 Base

Element	Limit of Detection	Element	Limit of Detection	Element	Limit of Detection	Element	Limit of Detection
	(less than)		(less than)		(less than)		(less than)
Cu	0.001%	Sn	0.001%	Mo	0.001%	Ge	0.01%*
Ti	0.001%	Co	0.001%	As	0.1%	Pt	0.001%
V	0.001%	Sr	0.001%	Sb	0.1%	Te	0.1%
Cr	0.001%	Ag	0.001%	Cd	0.01%	Y	0.1%
Mn	0.001%	Ga	0.01%*	Au	0.01%	Ru	?
Ni	0.001%	Zr	0.01%	W	0.1%	Cb	?
Ba	0.001%	Zn	0.01%	In	0.01%*	Li	?
Pb	0.001%	Bi	0.001%	Be	0.001%		

* Probably.

Table 2. Table Showing the Number of Occurrences of the Elements in the Rocks Studied and Their Per Cent Occurrence

Element	No. of Samples	% of Total	Element	No. of Samples	% of Total	Element	No. of Samples	% of Total
—	425	100	Sr	312	73	W	4	1
Cu	418	99	Ag	274	64	In	3	0.7
Ti	416	98	Ga	192	45	Li	2	0.5
V	413	97	Zr	158	37	Cb	2	0.5
Cr	411	97	Zn	141	33	Ge	2	0.5
Mn	408	96	Bi	107	25	Be	1	0.2
Ni	408	96	Mo	52	12	Pt	1	0.2
Ba	408	96	As	43	10	Ru	1	0.2
Pb	401	95	Sb	39	9	Te	1	0.2
Sn	383	90	Cd	21	5	Y	1	0.2
Co	364	83	Au	7	2			

Tables 2 and 3 give data concerning the presence of elements in the miscellaneous samples analyzed. The classification is necessarily very general. "Acid Igneous" includes the granitic and dioritic rocks and their extrusive equivalents; "Basic Igneous" includes basalts, gabbros, pyrox-

enites, amphibolites and similar rocks; "Magnetite" includes only massive magnetite; "Hydrothermal" refers to all rocks apparently formed by deposition from circulating waters; and "Miscellaneous" includes all samples which could not be classified, such as submitted, previously ground samples, rocks of such complexity as to preclude any definite classification, and rock mixtures.

TABLE 3. TABLE SHOWING THE NUMBER OF OCCURRENCES OF THE ELEMENTS IN THE ROUGHLY CLASSIFIED SAMPLES

Element	Acid Igneous	Basic Igneous	Magnetite	Hydrothermal	Sands and Sandstone	Shale	Limestone	Misc. Sedimentary	Metamorphic	Miscellaneous
No. of samples	47	34	13	84	36	51	16	15	51	78
Cu	47	34	13	84	35	48	16	15	50	76
Ti	47	32	13	84	36	51	16	15	50	72
V	43	33	13	82	36	50	14	15	50	77
Cr	46	34	12	78	35	50	15	13	51	78
Mn	46	34	13	74	33	50	15	15	51	77
Ni	45	33	13	78	35	50	13	13	51	77
Ba	45	33	13	81	34	51	16	14	50	71
Pb	47	33	11	80	34	46	16	13	50	71
Sn	47	33	11	73	32	42	14	11	48	72
Co	43	31	12	58	32	49	11	11	49	68
Sr	40	30	2	52	27	44	15	9	36	57
Ag	32	24	8	38	24	36	7	7	37	61
Ga	37	23	1	12	19	32	7	4	21	36
Zr	31	8	1	5	21	30	5	4	18	35
Zn	8	9	7	45	9	8	1	6	19	29
Bi	13	5	4	35	7	7	3	3	12	18
Mo	8	2	2	6	3	4	1	2	7	17
As	2	1	—	25	1	2	1	—	2	8
Sb	4	1	—	19	4	2	2	1	—	6
Cd	2	—	—	14	—	—	—	—	—	5
Au	—	—	—	3	2	—	—	—	—	2
W	—	—	—	2	—	1	—	—	—	1
In	—	—	—	2	—	—	—	—	—	1
Be	1	—	—	—	—	—	—	—	—	—
Cb	1	—	—	—	—	—	—	—	1	—
Ge	—	—	—	1	—	—	—	—	—	1
Li	1	—	—	—	—	—	—	—	1	—
Pt	—	—	—	—	1	—	—	—	—	—
Ru	1	—	—	—	—	—	—	—	—	—
Te	—	—	—	—	1	—	—	—	—	—
Y	—	—	—	1	—	—	—	—	—	—

Comments

1. The Y was found in a sample determined to be about 50 per cent fluorite and 40 per cent quartz.

2. The Te occurred in a sample of sand which also contained Au and Bi.

3. A trace of Pt was found in a sample of sand only after analysis of an assay bead.

4. Ge was found in a sample of a mixture of pyrite and quartz which also contained Pb, As, Zn, and Cd and a sample of pulp in which there was approximately 5 per cent Zn.

5. Be was found in a granitic appearing rock which had been altered by weathering.

6. The In occurred in samples containing Zn and Pb, always with more Zn than Pb.

7. In only two samples is Cd found and Zn not reported. Both are classified as acid igneous rocks.

8. Cb occurred in a large crystal of orthoclase which also contained traces of Li and Ru besides the usual trace elements, and a sample of schist, which also contained Li. Neither sample was otherwise obviously unusual.

9. The elements which are most often found are those which can be detected in the smallest amounts.

Due to the nature of the data, conclusions are not feasible, so that an attempt has been made only to summarize the results obtained over a long period of time by the use of the spectrograph.