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Spectrographic and chemical analyses of whole-rock and insoluble-residue samples, Rolla 1° x 2° quadrangle, Missouri: Drill hole No. 9

by

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Introduction

Geochemical studies of the Rolla, Mo., 1° x 2° quadrangle were begun in 1977 as a part of a joint multidisciplinary study of the quadrangle by the U.S. Geological Survey and the Division of Geology and Land Survey, Missouri Department of Natural Resources. The study is to access the mineral resource potential of the area by integrated geologic, geochemical, and geophysical studies.

The geochemical work to date has been directed at the characterization of the sedimentary and igneous rocks in the quadrangle through spectrographic and chemical analyses of whole-rock samples and dilute-hydrochloric-acid insoluble-residue samples of whole rock from widely spaced drill holes. Sixty-two drill holes have been selected for study from the sample library of the Missouri Division of Geology and Land Survey. None of the holes are company confidential, none intersect economically significant mineralized ground, and only a few are located in known ore-bearing trends.

The analytical results for drill hole No. 9, Missouri log number 21325, are given in this report. The drill hole is located in sec. 29, T. 29 N., R. 2 E. in Reynolds County. Data of the whole-rock samples are listed in table 1, and data of the insoluble-residue samples are listed in table 2. Missouri log number, county, and location allow correlation with the stratigraphic logs on file at the Missouri Division of Geology and Land Survey in Rolla, Mo.

Preparation and analysis of samples

The samples were pulverized to minus-140-mesh (0.105 mm) in a vertical grinder with ceramic plates. Some insoluble-residue samples contained only a few milligrams of material, and these were hand ground in an agate mortar and pestle. A hand magnet was passed over the insoluble residue samples before grinding to remove filings or chips of drill bit that might be present.

Each sample was analyzed semiquantitatively for 31 elements using a six-step, D.C.-arc, optical-emission spectrographic method (Grimes and Marranzino, 1968). In addition, where sufficient sample was available, each sample was analyzed for zinc by an atomic-absorption technique using deuturium background correction (Ward and others, 1969, p. 33).

The semiquantitative spectrographic values are reported as six steps per order of magnitude (1, 0.7, 0.5, 0.3, 0.2, 0.15, or multiples of 10 of these numbers) and are approximate geometric midpoints of the concentration ranges. The precision is shown to be within one adjoining reporting inverval on each side of the reported values 83 percent of the time and within two adjoining intervals on each side of the reported value 96 percent of the time (Motooka and Grimes, 1976).

The visual lower limits of determination for the 31 elements determined spectrographically included in this report are as follows:

For those given in percent:

Calcium	0.05
Iron	0.05
Magnesium	0.02
Titanium	0.002

For those given in ppm:

Antimony	100	Nickel	5
Arsenic	200	Niobium	20
Barium	20	Scandium	5
Beryllium	1	Silver	0.5
Bismuth	10	Strontium	100
Boron	10	Thorium	100
Cadmium	20	Tin	10
Chromium	10	Tungsten	50
Cobalt	5	Vanadium	10
Copper	5	Yttrium	10
Gold	10	Zinc	200
Lanthanum	20	Zirconium	10
Lead	10		
Manganese	10		
Molybdenum	5		

Description of samples

Each sample is identified by an eight-character code. The first three numbers signify the USGS hole number (for example, 001=hole 1, 002=hole 2, and so forth). These three numbers are followed by a capital letter (W, U, or I), which indicates washed (W) or unwashed (U) whole rock in table 1 and insoluble residue (I) in table 2. The last four digits identify the depth of the sample from the drill-hole collar. Each sample is a composite of 10 feet of drill core from above the depth indicated.

The stratigraphic unit of the sample is identified by a coded number in the first column (tables 1 and 2) following the sample number. The code and formation names are as follows:

code	formation
1	Precambrian rocks
2	Lamotte Sandstone
3	Bonneterre Formation
4	Davis Formation
5	Derby-Doe Run* Formation
6	Potosi Dolomite
7	Eminence Dolomite
8	Gunter Sandstone Member of Gasconade Dolomite
9	Gasconade Dolomite (part)
10	Roubidoux Formation
11	Residuum
13	Basal conglomerate
14	Derby-Doe Run and Davis Formations, undifferentiated
16	Van Buren Formation

*As used by McCracken, 1961.

The columns in tables 1 and 2 have headings of sample, formation, and elements. Columns in which the element heading is preceded by an S contain the emission-spectrographic data. The prefix AA in the zinc column heading indicates that the results were determined by atomic absorption.

Iron, magnesium, calcium, and titanium are reported in percent (%); all other elements are in parts per million . Other symbols shown on the tables are:

N = Not detected at the level of detection;

-- = Not determined;

< = Detected, but below the lowest limit of detection, which is value shown; and

> = Greater than value shown.

Elements that were not detected in any of the samples of a sample set (whole rock or insoluble residue) are not reported in the tables.

References cited

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analyses of geologic materials: U.S. Geol. Survey Circ. 591, 6 p.

Motooka, J. M., and Grimes, D. J., 1976, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geol. Survey Circ. 738, 25 p.

Ward, F. N., Nakagawa, H. M., Harms, T. F., and Van Sickle, G. H., 1969, Atomic absorption methods of analysis useful in geochemical exploration: U.S. Geol. Survey Bull. 1289, 45 p.

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-NI	S-PB	S-SC
009W0010	11	.30	.05	.10	.015	150	N	10	30	N	7	N	<5	N	N	N	N
009W0040	11	.20	2.00	2.00	.015	100	N	20	20	N	N	N	<5	N	N	N	N
009W0050	11	.07	.50	.70	.005	15	N	15	20	N	N	N	<5	N	N	N	N
009W0060	11	.10	.70	1.00	.007	30	N	15	20	N	N	N	<5	N	N	N	N
009W0070	7	.20	3.00	5.00	.010	70	N	15	<20	N	N	N	<5	N	N	N	N
009W0080	7	.30	2.00	2.00	.015	100	N	15	20	N	N	N	5	N	<5	N	N
009W0120	7	.15	7.00	15.00	.007	150	N	<10	20	N	N	N	15	N	N	N	N
009W0130	7	.10	5.00	7.00	.007	100	N	10	<20	N	N	N	N	N	N	N	N
009W0140	6	.15	3.00	5.00	.007	150	N	10	<20	N	5	N	<5	N	N	N	N
009W0150	6	.10	5.00	10.00	.007	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0160	6	.15	5.00	10.00	.007	100	N	<10	<20	N	N	N	N	N	N	N	N
009W0170	6	.10	7.00	15.00	.007	150	N	<10	20	N	N	N	N	N	N	N	N
009W0180	6	.30	7.00	15.00	.015	150	N	<10	20	N	N	<10	<5	N	N	N	N
009W0190	6	.10	7.00	15.00	.007	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0200	6	.10	7.00	15.00	.007	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0210	6	.15	7.00	15.00	.007	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0220	6	.15	7.00	15.00	.010	150	N	<10	<20	N	N	N	<5	N	N	N	N
009W0230	6	.15	7.00	15.00	.010	500	N	<10	150	N	N	N	<5	N	N	N	N
009W0240	6	.10	7.00	15.00	.015	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0250	6	.20	7.00	15.00	.010	200	N	<10	30	N	N	N	<5	N	N	N	N
009W0260	6	.15	7.00	15.00	.010	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0270	6	.20	7.00	15.00	.010	100	N	<10	<20	N	N	N	<5	N	N	N	N
009W0280	6	.20	7.00	15.00	.010	100	N	N	<20	N	N	N	<5	N	N	N	N
009W0290	6	.15	7.00	15.00	.007	100	N	N	<20	N	N	N	<5	N	N	N	N
009W0300	6	.15	7.00	15.00	.015	150	N	<10	<20	N	N	N	<5	N	N	N	N
009W0310	6	.20	7.00	15.00	.007	70	N	N	<20	N	N	N	<5	N	N	N	N
009W0320	6	.10	7.00	15.00	.007	50	N	N	N	N	N	N	<5	N	N	N	N
009W0330	6	.20	7.00	15.00	.010	100	N	N	N	N	N	N	<5	N	N	N	N
009W0340	6	.15	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0350	6	.15	7.00	15.00	.007	100	N	N	N	N	N	N	<5	N	N	N	N
009W0360	6	.20	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0370	6	.20	7.00	15.00	.007	100	N	N	N	N	N	N	<5	N	N	N	N
009W0380	6	.15	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0390	6	.10	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0400	6	.20	7.00	15.00	.007	100	N	N	N	N	N	N	<5	N	N	N	N
009W0410	6	.20	7.00	15.00	.010	70	N	N	N	N	N	N	<5	N	N	N	N
009W0420	6	.15	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0430	6	.15	7.00	15.00	.010	70	N	N	N	N	N	N	<5	N	N	N	N
009W0440	6	.20	7.00	15.00	.010	100	N	N	N	N	N	N	<5	N	N	N	N
009W0450	6	.20	7.00	15.00	.010	100	N	N	N	N	N	N	<5	N	N	N	N
009W0460	6	.20	7.00	15.00	.007	150	N	N	N	N	N	N	<5	N	N	N	N
009W0470	6	.20	7.00	15.00	.010	70	N	N	N	N	N	N	<5	N	N	N	N
009W0480	6	.30	7.00	15.00	.007	150	N	N	N	N	N	N	<5	N	N	N	N
009W0490	6	.20	7.00	15.00	.007	70	N	N	N	N	N	N	<5	N	N	N	N
009W0500	6	.20	7.00	15.00	.010	100	N	N	N	N	N	N	<5	N	N	N	N

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-SR	S-V	S-Y	S-ZR	AA-ZN-P
009W0010	N	10	N	10	2
009W0040	N	15	N	N	4
009W0050	N	15	N	N	3
009W0060	N	10	N	N	2
009W0070	N	20	N	N	3
009W0080	N	20	N	N	8
009W0120	N	10	N	N	2
009W0130	N	<10	N	N	2
009W0140	N	10	N	N	8
009W0150	N	10	N	N	3
009W0160	100	10	N	N	3
009W0170	100	10	N	N	2
009W0180	100	15	N	N	4
009W0190	N	10	N	N	3
009W0200	100	10	N	N	2
009W0210	100	15	N	N	3
009W0220	100	15	N	N	3
009W0230	100	15	N	N	3
009W0240	100	15	N	N	1
009W0250	100	15	N	N	3
009W0260	100	15	N	N	2
009W0270	100	15	N	N	2
009W0280	100	15	N	N	2
009W0290	100	15	N	N	5
009W0300	100	20	N	N	5
009W0310	100	10	N	N	5
009W0320	100	10	N	N	5
009W0330	100	15	N	N	4
009W0340	100	10	N	N	5
009W0350	100	15	N	N	7
009W0360	N	15	N	N	4
009W0370	100	15	N	N	3
009W0380	100	15	N	N	5
009W0390	100	15	N	N	3
009W0400	100	15	N	N	3
009W0410	N	15	N	N	3
009W0420	N	15	N	N	2
009W0430	100	15	N	N	2
009W0440	100	15	N	N	3
009W0450	100	15	N	N	3
009W0460	100	15	N	N	4
009W0470	100	15	N	N	2
009W0480	100	15	N	N	2
009W0490	100	15	N	N	N
009W0500	100	10	N	N	3

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-NI	S-PB	S-SC
009W0510	6	.15	7.00	15.00	.010	100	N	N	N	N	N	N	<5	N	N	N	N
009W0520	6	.15	7.00	15.00	.007	100	N	N	N	N	N	N	N	N	N	N	N
009W0530	6	.15	7.00	15.00	.007	100	N	N	N	N	N	N	N	N	N	N	N
009W0540	6	.15	7.00	15.00	.005	70	N	N	N	N	N	N	N	N	N	N	N
009W0550	6	.15	7.00	15.00	.007	70	N	N	N	N	N	N	N	N	N	N	N
009W0560	5	.50	7.00	15.00	.010	150	N	N	N	N	N	<10	<5	N	N	N	N
009W0570	5	.30	7.00	15.00	.010	150	N	N	N	N	N	<10	<5	N	N	N	N
009W0580	5	.30	7.00	15.00	.007	150	N	N	N	N	N	<10	<5	N	N	N	N
009W0590	5	.20	7.00	15.00	.005	100	N	N	N	N	N	<10	N	N	N	N	N
009W0600	5	.20	7.00	15.00	.005	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0610	5	.30	7.00	15.00	.007	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0620	5	.30	7.00	15.00	.007	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0625	5	.30	7.00	15.00	.007	150	N	N	N	N	N	N	<5	N	N	10	N
009W0640	5	.10	7.00	15.00	.007	100	N	N	N	N	N	N	<5	N	N	N	N
009W0650	5	.15	7.00	15.00	.003	100	N	N	N	N	N	N	N	N	N	N	N
009W0660	5	.20	7.00	15.00	.007	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0670	4	.20	7.00	15.00	.005	150	N	N	N	N	N	<10	<5	N	N	N	N
009W0680	4	.15	7.00	15.00	.007	70	N	N	N	N	N	<10	<5	N	N	N	N
009W0690	4	.20	7.00	15.00	.007	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0700	4	.15	7.00	15.00	.005	100	N	N	N	N	N	<10	<5	N	N	N	N
009W0710	4	.20	7.00	15.00	.007	150	N	N	N	N	N	<10	<5	N	N	N	N
009W0720	4	.30	7.00	15.00	.007	200	N	N	N	N	N	<10	<5	N	N	N	N
009W0730	4	.30	7.00	15.00	.015	200	N	<10	N	N	N	<10	<5	N	N	N	N
009W0740	4	.50	7.00	20.00	.015	300	N	<10	N	N	N	10	<5	N	N	20	N
009W0750	4	.70	7.00	20.00	.030	300	N	<10	N	N	5	20	<5	N	10	50	N
009W0760	4	.50	7.00	15.00	.030	300	N	<10	N	N	<5	10	<5	N	5	20	N
009W0770	4	.50	7.00	20.00	.030	300	N	<10	N	N	N	10	<5	N	<5	N	N
009W0780	4	.30	7.00	15.00	.010	500	N	<10	N	N	N	N	<5	N	N	10	N
009W0790	4	.50	7.00	15.00	.020	300	N	<10	N	N	5	<10	<5	N	5	30	N
009W0800	4	.50	7.00	20.00	.015	300	N	N	N	N	N	<10	<5	N	<5	15	N
009W0810	4	.50	7.00	15.00	.015	500	N	<10	N	N	<5	<10	<5	N	<5	50	N
009W0820	4	.50	7.00	15.00	.050	300	N	<10	N	N	5	10	<5	N	7	50	N
009W0830	4	.50	7.00	15.00	.030	300	N	<10	N	N	N	10	<5	N	<5	70	N
009W0840	4	.30	7.00	20.00	.015	500	N	N	N	N	N	<10	<5	N	N	N	N
009W0850	4	.50	7.00	15.00	.070	500	N	<10	<20	N	N	15	<5	N	<5	N	N
009W0860	3	.50	7.00	20.00	.050	700	N	<10	<20	N	<5	15	<5	N	5	15	N
009W0870	3	.30	7.00	15.00	.100	500	N	<10	70	N	N	15	<5	N	<5	N	N
009W0880	3	.30	7.00	15.00	.030	700	N	N	<20	N	N	<10	N	N	<5	N	N
009W0890	3	.50	7.00	20.00	.007	1,000	N	N	N	N	N	N	N	N	<5	10	N
009W0900	3	.70	7.00	15.00	.070	1,000	N	<10	30	N	N	20	<5	N	<5	20	N
009W0910	3	.50	7.00	20.00	.030	700	N	N	<20	N	N	10	<5	N	<5	30	N
009W0920	3	.70	7.00	15.00	.100	1,500	N	15	<20	N	N	15	<5	N	5	50	N
009W0930	3	1.50	7.00	15.00	.150	2,000	N	50	<20	1.5	15	30	7	N	50	20	5
009W0940	3	1.50	7.00	20.00	.070	2,000	N	30	N	N	<5	20	<5	N	7	N	N
009W0950	3	.70	7.00	15.00	.030	1,500	N	15	N	N	N	10	N	N	<5	N	N

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-SR	S-V	S-Y	S-ZR	AA-ZN-P
009W0510	100	10	N	N	1
009W0520	100	10	N	N	N
009W0530	100	<10	N	N	N
009W0540	100	<10	N	N	4
009W0550	100	<10	N	N	4
009W0560	150	15	N	N	6
009W0570	100	15	N	N	5
009W0580	100	10	N	N	4
009W0590	100	10	N	N	3
009W0600	N	10	N	N	3
009W0610	100	10	N	N	5
009W0620	100	15	N	N	5
009W0625	100	15	N	N	6
009W0640	100	10	N	N	3
009W0650	100	10	N	N	4
009W0660	100	15	N	N	5
009W0670	100	15	N	N	3
009W0680	100	10	N	N	2
009W0690	100	10	N	N	4
009W0700	100	10	N	N	2
009W0710	100	10	N	N	2
009W0720	100	N	N	N	4
009W0730	100	N	N	10	2
009W0740	100	15	N	N	15
009W0750	N	20	N	10	27
009W0760	100	15	N	10	4
009W0770	100	10	<10	10	5
009W0780	100	N	N	N	4
009W0790	100	N	N	10	2
009W0800	100	<10	N	N	7
009W0810	100	<10	<10	N	2
009W0820	100	<10	<10	15	N
009W0830	100	10	<10	10	3
009W0840	100	10	N	N	3
009W0850	N	15	<10	30	7
009W0860	100	15	<10	15	1
009W0870	100	20	10	70	3
009W0880	100	10	<10	20	15
009W0890	N	N	N	N	23
009W0900	100	20	10	20	20
009W0910	N	10	10	15	20
009W0920	100	15	10	30	12
009W0930	100	30	15	50	1
009W0940	N	20	15	20	N
009W0950	N	10	<10	15	2

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-NI	S-PB	S-SC
C09W0960	3	1.00	7.00	15.00	.050	1,500	1.0	15	N	1.0	N	10	N	N	5	N	N
C09W0970	3	1.00	7.00	15.00	.015	2,000	N	10	N	N	N	<10	N	N	N	N	N
C09W0980	3	2.00	7.00	15.00	.050	1,500	N	20	N	1.0	N	15	<5	N	7	10	N
C09W0990	3	1.00	7.00	15.00	.070	2,000	N	20	N	1.5	N	10	<5	N	5	N	N
C09W1000	3	1.50	7.00	15.00	.100	2,000	N	50	<20	1.5	5	20	7	20	10	50	5
C09W1010	3	1.50	7.00	15.00	.100	1,500	N	30	<20	1.5	N	20	N	20	10	N	5
C09W1020	3	1.50	7.00	15.00	.150	1,500	N	50	<20	1.5	N	20	N	20	15	N	5
C09W1030	3	1.00	7.00	15.00	.050	1,500	N	30	N	N	N	10	N	N	5	N	N
C09W1040	13	1.00	1.50	1.50	.200	150	N	70	<20	3.0	5	10	<5	50	15	N	7
C09W1050	13	1.50	.70	.70	.200	150	N	100	30	3.0	7	15	50	50	20	N	7
C09W1060	13	1.50	.30	.05	.200	30	N	100	<20	3.0	5	10	<5	50	7	N	7

Table 1.--Spectrographic and atomic-absorption analyses of whole-rock samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-SR	S-V	S-Y	S-ZR	AA-ZN-P
009W0960	100	10	10	50	2
009W0970	100	<10	<10	10	N
009W0980	100	10	15	20	5
009W0990	100	10	30	70	3
009W1000	100	20	20	50	8
009W1010	100	20	20	30	9
009W1020	100	30	20	70	7
009W1030	N	20	15	20	3
009W1040	100	30	50	200	3
009W1050	100	50	30	150	9
009W1060	100	50	70	150	4

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-MO	S-NI
00910010	11	.10	.02	.07	.010	10	N	10	<20	N	N	N	N	N	N	N
00910040	11	.10	.03	.05	.010	10	N	20	<20	N	N	N	<5	N	N	N
00910050	11	.05	<.02	.05	.005	<10	N	15	<20	N	N	N	<5	N	N	N
00910060	11	.05	<.02	.05	.005	<10	N	15	<20	N	N	N	<5	N	N	N
00910070	7	.07	.02	.05	.007	<10	N	20	<20	N	N	N	N	N	N	N
00910080	7	.07	.03	.07	.007	<10	N	20	<20	N	N	N	<5	N	N	N
00910120	7	.05	.02	<.05	.005	<10	N	20	<20	N	N	N	<5	N	N	N
00910130	7	.10	.02	.05	.005	<10	N	15	<20	N	N	N	N	N	N	N
00910140	6	.70	.03	.05	.005	70	N	15	<20	1.5	10	N	<5	N	N	10
00910150	6	.05	.03	.07	.005	15	N	15	20	N	N	N	N	N	N	N
00910160	6	<.05	.02	.07	.003	<10	N	15	<20	N	N	N	N	N	N	N
00910170	6	<.05	.02	.07	.005	<10	N	15	<20	N	N	N	N	N	N	N
00910180	6	.20	.03	.07	.010	150	N	15	100	N	N	N	N	N	N	N
00910190	6	.07	.02	.05	.002	20	N	15	30	N	N	N	N	N	N	N
00910200	6	.05	.02	.05	.002	50	N	15	30	N	N	N	N	N	N	N
00910210	6	.05	.02	.05	.005	10	N	15	20	N	N	N	N	N	N	N
00910220	6	.07	.03	.05	.007	15	N	15	20	N	N	N	N	N	N	N
00910230	6	.07	.02	<.05	.003	200	N	15	150	N	N	N	N	N	N	N
00910240	6	.05	.15	.20	.007	1,000	N	20	300	N	N	N	N	N	N	N
00910250	6	.10	.03	.05	.007	150	N	15	70	N	N	N	N	N	N	N
00910260	6	.05	.02	.05	.005	150	N	15	70	N	N	N	N	N	N	N
00910270	6	.05	.02	.05	.007	50	N	15	20	N	N	N	N	N	N	N
00910280	6	.05	.05	.05	.007	<10	N	20	<20	N	N	N	N	N	N	N
00910290	6	<.05	.05	.07	.005	20	N	20	20	N	N	N	N	N	N	N
00910300	6	.15	.10	.07	.030	10	N	20	30	N	N	N	N	N	N	N
00910310	6	.07	.07	.07	.007	10	N	15	20	N	N	N	N	N	N	N
00910320	6	.07	.05	.07	.007	10	N	15	30	N	N	N	N	N	N	N
00910330	6	.07	.07	.10	.007	10	N	15	30	N	N	N	N	N	N	N
00910340	6	.10	.07	.10	.007	150	N	15	70	N	N	N	5	N	N	N
00910350	6	.30	.05	.07	.005	20	N	15	<20	N	N	N	15	N	N	N
00910360	6	.30	.07	.10	.007	15	N	20	30	N	N	N	10	N	N	5
00910370	6	.07	.10	.10	.003	<10	N	15	20	N	N	N	N	N	N	N
00910380	6	.05	.05	.07	.002	<10	N	15	N	N	N	N	7	N	N	N
00910390	6	.07	.05	.05	<.002	100	N	15	20	N	N	N	N	N	N	N
00910395	6	.07	.05	.07	.007	15	N	20	<20	N	N	N	N	N	N	N
00910400	6	1.50	.30	.20	.150	100	N	15	50	2.0	N	20	10	30	N	20
00910410	6	.70	.10	.10	.010	70	N	15	<20	N	N	<10	N	N	N	<5
00910420	6	.50	.20	.30	.020	30	N	15	<20	N	N	N	7	N	N	<5
00910430	6	.05	.05	.07	.007	<10	N	15	<20	N	N	N	N	N	N	N
00910440	6	.10	.07	.05	.020	<10	N	20	<20	N	N	N	<5	N	N	N
00910450	6	.20	.07	.10	.007	10	N	20	20	N	N	N	20	N	N	N
00910470	6	.05	.03	.05	.010	15	N	15	<20	N	N	N	<5	N	N	N
00910480	6	.07	.02	<.05	.007	2,000	N	15	700	N	N	N	N	N	N	N
00910490	6	.10	.07	.05	.015	200	N	20	50	N	N	N	N	N	N	N
00910500	6	.15	.05	.05	.015	1,000	N	20	300	N	N	N	<5	N	N	N

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-PB	S-SC	S-SN	S-V	S-Y	S-ZR	AA-ZN-P
00910010	N	N	N	<10	N	N	2
00910040	N	N	N	<10	N	N	2
00910050	N	N	N	15	N	N	3
00910060	N	N	N	15	N	N	1
00910070	N	N	N	15	N	N	N
00910080	N	N	N	15	N	N	N
00910120	N	N	N	10	N	N	4
00910130	N	N	N	10	N	N	1
00910140	N	N	N	15	N	N	60
00910150	N	N	N	10	N	N	1
00910160	N	N	N	N	N	N	N
00910170	N	N	N	<10	N	N	N
00910180	N	N	N	10	N	N	11
00910190	N	N	N	<10	N	N	3
00910200	N	N	N	<10	N	N	1
00910210	N	N	N	<10	N	N	2
00910220	N	N	N	<10	N	N	N
00910230	N	N	N	<10	N	N	1
00910240	N	N	N	10	N	N	2
00910250	N	N	N	<10	N	N	1
00910260	N	N	N	<10	N	N	N
00910270	N	N	N	<10	N	N	N
00910280	N	N	N	N	N	N	N
00910290	N	N	N	N	N	N	N
00910300	N	N	N	20	N	15	2
00910310	N	N	N	N	N	N	N
00910320	N	N	N	N	N	N	N
00910330	N	N	N	N	N	N	N
00910340	N	N	N	N	N	N	N
00910350	N	N	N	N	N	N	N
00910360	N	N	N	N	N	N	--
00910370	N	N	N	N	N	N	--
00910380	N	N	N	N	N	N	N
00910390	N	N	N	N	N	N	--
00910395	N	N	N	N	N	N	--
00910400	N	10	N	70	30	70	12
00910410	N	N	N	15	N	10	N
00910420	N	N	N	10	N	30	--
00910430	N	N	N	N	N	N	--
00910440	N	N	N	10	N	10	N
00910450	N	N	N	N	N	N	--
00910470	N	N	N	N	N	N	--
00910480	N	N	N	N	N	N	--
00910490	N	N	N	10	N	10	--
00910500	N	N	N	15	N	N	--

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-MO	S-NI
00910510	6	.15	.10	.05	.050	200	N	30	150	N	N	N	<5	N	N	N
00910520	6	.20	.10	.07	.020	10	N	30	<20	N	N	N	<5	N	N	N
00910530	6	.07	.07	.05	.030	500	N	20	200	N	N	N	<5	N	N	N
00910540	6	.20	.10	.07	.100	1,000	N	20	500	N	N	N	5	N	N	N
00910550	6	.15	.07	.07	.070	50	N	20	100	N	N	N	<5	N	N	N
00910560	5	.50	.50	.05	.200	1,000	N	50	300	2.0	N	50	<5	N	N	10
00910570	5	.30	.20	.20	.050	50	N	30	<20	N	N	10	<5	N	N	<5
00910580	5	.30	.15	.05	.070	70	N	30	30	N	N	20	<5	N	N	<5
00910590	5	.20	.20	.10	.100	30	N	30	150	N	N	30	<5	N	N	<5
00910600	5	.15	.15	.10	.030	70	N	20	70	N	N	10	5	N	N	<5
00910610	5	.30	.15	.30	.050	500	N	20	150	N	N	10	<5	N	N	5
00910620	5	.15	.10	.10	.020	200	N	20	100	N	N	<10	<5	N	N	<5
00910625	5	.05	.15	.30	.005	<10	N	20	30	N	N	N	N	N	N	<5
00910640	5	.07	.15	.30	.020	<10	N	20	<20	N	N	N	N	N	N	N
00910650	5	<.05	.10	.20	.005	<10	N	15	20	N	N	N	N	N	N	N
00910660	5	.05	.15	.15	.020	<10	N	20	50	N	N	N	10	N	N	N
00910670	5	.10	.15	.05	.050	<10	N	20	50	N	N	10	7	N	N	<5
00910680	4	.50	.50	.20	.300	<10	N	50	150	1.0	N	70	<5	N	N	5
00910690	4	<.05	.07	.07	.007	<10	N	20	50	N	N	N	N	N	N	N
00910700	4	.10	.15	.20	.030	<10	N	20	70	N	N	<10	7	N	N	N
00910710	4	10.00	1.00	2.00	.200	50	3.0	50	150	2.0	50	70	50	N	150	100
00910720	4	2.00	.70	.07	.200	15	.5	70	50	3.0	20	70	15	20	15	70
00910730	4	2.00	1.50	.10	.300	30	N	100	70	5.0	10	100	<5	N	N	50
00910740	4	2.00	1.50	.10	.500	30	N	100	70	5.0	10	100	<5	20	5	30
00910750	4	7.00	1.50	.10	.300	30	3.0	70	70	3.0	50	100	30	N	10	70
00910760	4	1.50	1.00	.07	.200	15	.7	100	50	3.0	20	70	10	20	N	50
00910770	4	3.00	2.00	.10	.500	50	1.5	150	100	5.0	30	100	20	30	N	70
00910780	4	15.00	.50	.07	.200	70	5.0	100	50	2.0	100	50	50	N	N	150
00910790	4	5.00	1.50	.07	.300	50	2.0	100	70	5.0	20	100	20	N	N	70
00910800	4	20.00	.50	.05	.150	100	2.0	50	50	3.0	70	50	50	N	N	50
00910810	4	3.00	.50	.05	.200	<10	1.0	50	70	2.0	20	100	15	N	N	30
00910820	4	3.00	2.00	.50	.500	70	1.5	100	150	3.0	70	100	10	N	N	70
00910830	4	1.00	.70	.07	.300	10	N	70	100	3.0	15	100	10	N	N	30
00910840	4	1.50	1.00	.05	.300	30	N	100	150	3.0	20	200	5	N	N	50
00910850	4	1.50	1.50	.20	.300	30	.7	100	200	5.0	10	150	15	20	N	30
00910855	3	.20	.15	<.05	.150	10	N	20	200	N	N	10	10	N	N	N
00910860	3	2.00	1.00	.30	.300	50	1.5	50	300	3.0	50	100	50	N	N	70
00910870	3	1.00	1.00	.50	.300	30	N	50	500	2.0	5	70	10	N	N	15
00910880	3	.50	.30	.07	.150	10	N	30	300	1.0	N	30	<5	N	N	5
00910890	3	.30	.20	.05	.100	10	N	30	300	N	N	15	<5	N	N	5
00910900	3	1.00	.50	.10	.150	20	N	50	300	2.0	5	50	5	N	N	7
00910910	3	1.00	.70	.07	.300	20	N	50	300	2.0	5	50	<5	N	N	10
00910920	3	2.00	1.50	.10	.500	30	N	150	100	3.0	10	100	7	30	N	50
00910930	3	3.00	1.50	.10	.500	50	N	200	70	3.0	70	100	70	50	N	150
00910940	3	2.00	1.50	.10	.500	20	N	150	100	3.0	10	100	10	50	N	50

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-PB	S-SC	S-SN	S-V	S-Y	S-ZR	AA-ZN-P
00910510	N	N	N	20	N	15	--
00910520	N	N	N	15	N	10	--
00910530	N	N	N	15	N	10	--
00910540	N	N	N	15	N	15	--
00910550	N	N	N	10	N	70	--
00910560	N	N	N	100	N	50	--
00910570	N	N	N	20	N	15	--
00910580	N	N	N	30	N	20	--
00910590	N	N	N	50	N	20	--
00910600	N	N	N	15	N	10	--
00910610	N	N	N	20	N	15	--
00910620	N	N	N	10	N	10	--
00910625	N	N	N	N	N	N	N
00910640	N	N	N	N	N	20	--
00910650	N	N	N	N	N	10	--
00910660	N	N	N	N	N	20	--
00910670	N	N	N	10	N	20	--
00910680	N	N	N	150	10	150	--
00910690	N	N	N	N	N	N	N
00910700	N	N	N	10	N	20	N
00910710	500	N	N	70	15	100	24
00910720	70	7	N	70	15	150	12
00910730	200	7	N	100	10	150	N
00910740	30	7	N	150	15	100	N
00910750	700	5	N	100	10	70	N
00910760	100	5	N	70	10	70	N
00910770	500	10	N	100	20	150	N
00910780	700	5	N	50	15	100	--
00910790	300	7	N	100	15	150	2
00910800	1,000	5	N	30	N	50	N
00910810	100	7	N	70	10	100	N
00910820	200	7	N	100	15	150	N
00910830	N	7	N	70	15	100	N
00910840	N	5	N	200	20	200	N
00910850	N	10	N	100	15	150	N
00910855	N	N	N	10	20	200	N
00910860	200	5	N	100	10	150	N
00910870	10	7	N	70	20	200	N
00910880	N	N	N	50	15	200	N
00910890	N	N	N	30	10	150	--
00910900	N	7	N	100	15	100	1
00910910	N	7	N	100	20	300	N
00910920	30	7	N	150	30	200	1
00910930	70	10	N	150	30	200	2
00910940	50	10	N	100	20	150	1

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	FORM	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR	S-CU	S-LA	S-MO	S-NI
00910950	3	1.50	1.00	.07	.300	30	N	200	50	3.0	10	50	7	30	N	50
00910960	3	1.50	.70	.15	.300	70	N	150	50	2.0	10	30	<5	30	N	30
00910970	3	1.50	1.00	.05	.200	50	N	150	50	3.0	10	70	15	30	N	50
00910980	3	3.00	1.50	.05	.300	30	N	200	70	3.0	15	70	20	70	N	70
00910990	3	2.00	1.50	.05	.300	30	N	150	70	3.0	10	70	10	70	N	70
00911000	3	3.00	1.00	.10	.300	50	N	150	70	3.0	20	50	15	70	N	70
00911010	3	3.00	1.00	.07	.200	70	N	150	70	3.0	10	50	5	50	N	50
00911020	3	2.00	1.00	.07	.200	50	N	150	50	3.0	7	30	<5	50	N	30
00911030	3	2.00	.70	.05	.200	30	N	200	30	3.0	7	20	<5	50	N	20
00911035	13	1.50	.70	<.05	.200	20	N	150	30	3.0	7	15	<5	70	N	20
00911040	13	.50	.15	<.05	.100	<10	N	30	<20	1.5	N	<10	N	30	N	5
00911050	13	.70	.30	.07	.100	30	N	50	20	2.0	5	10	5	20	N	7
00911055	13	.50	.20	<.05	.100	10	N	50	<20	2.0	N	<10	<5	30	N	5
00911060	13	2.00	.50	<.05	.200	50	N	100	<20	3.0	5	20	N	100	N	7

Table 2.--Spectrographic and atomic-absorption analyses of insoluble-residue samples from drill hole no. 9, Rolla 1° X 2° quadrangle, Missouri--continued

sample	S-PB	S-SC	S-SN	S-V	S-Y	S-ZR	AA-ZN-P
00910950	N	5	N	70	15	150	2
00910960	N	5	15	70	70	1,000	5
00910970	10	7	10	100	15	70	21
00910980	70	10	N	100	30	100	24
00910990	20	10	15	100	50	200	32
00911000	70	10	10	100	30	150	19
00911010	10	7	10	100	20	100	22
00911020	N	7	10	70	20	100	18
00911030	N	7	10	70	20	150	11
00911035	N	10	10	50	50	300	10
00911040	N	5	N	15	20	100	N
00911050	N	5	N	50	30	100	4
00911055	N	5	N	30	30	150	1
00911060	N	10	N	50	50	100	5