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# Spectrographic and chemical analyses of exposed Precambrian rocks, Rolla 1° X 2° quadrangle, Missouri

by

W. P. Pratt, S. K. Odland, A. E. Hubert, D. F. Siems, and J. G. Viets

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Contents



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## Introduction

Outcrops of Precambrian rocks in the St. Francois Mountains region of southeast Missouri were sampled extensively in 1976-78 as part of an integrated geologic-geochemical-geophysical appraisal of the mineral resource potential of the Rolla 1° X 2° quadrangle, being conducted by the U. S. Geological Survey in cooperation with the Missouri Department of Natural Resources, Division of Geology and Land Survey.

The primary purpose for sampling the Precambrian rocks was for petrographic studies, which were used in preparing a new geologic map of the exposed Precambrian of Missouri (Pratt and others, 1979). Of several hundred samples collected, 185 were analyzed by standard semiquantitative spectrographic methods for 31 elements, by X-ray fluorescence for 7 major oxides (Si, Al, Fe, Ca, K, Ti, P), and by atomic absorption spectrometry for Na and Mg. In addition, 56 of the same samples were analyzed by atomic absorption spectrometry for Ag, Bi, Cd, Cu, Pb, Sb, Sn, and Zn, by colorimetric methods for As and W, by mercury analizer for Hg, and by an ion-selective electrode method for F. The results of these analyses are presented in table 2. Sample locations are shown on the map, plate 1.

The samples were collected by Pratt and this report was assembled by Pratt and Odland, with assistance in preparing parts of the text by Hubert, Siems, and Viets. Analysts were Hubert (X-ray fluorescence), Siems (spectrographic) and Viets, S. M. Kneipple, and J. Sharkey (other chemical methods).

## Description of samples

The samples were chips of hand specimens collected from bedrock outcrops, and are representative of most of the principal volcanic rock types and a few of the intrusive rock types exposed in the region. The rock type of each sample is identified in table 2 by a symbol following the sample number. These symbols correspond to lithologic units used on the new geologic map (Pratt and others, 1979), as listed below; the lithology and correlation of the units are discussed in the text accompanying the geologic map.

### Granitic Rocks

Ygh High-silica biotite granite, Butler Hill type (Butler Hill Granite of Hayes, 1961)

Ygg Granophyric high-silica biotite granite, Breadtray type (Breadtray Granite of Hayes, 1961)

Ygm Medium-silica amphibole-orthoclase granite, Slabtown type (Slabtown Granite of Hayes, 1961)

### Hypabyssal Rocks

Yhm Fine-grained equivalent of medium-silica amphibole-orthoclase granite

Ymd Mudlick Dellenite of Tolman and Robertson (1969)

### Volcanic Rocks

Yar Alkali-rhyolites

Yart Taum Sauk Rhyolite of Berry (1976)

Yarr Royal Gorge Rhyolite of Berry (1976)

Yarb Bell Mountain Rhyolite, Wildcat Mountain Rhyolite, and Russell Mountain Rhyolite of Berry (1976)

Yari Lindsey Mountain Rhyolite and Ironton Rhyolite of Berry (1976)

Yag Grassy Mountain Ignimbrite of Sides (1976) and identical rocks outside the Lake Killarney quadrangle

Yr Rhyolites (west of Ironton, equivalent to Cedar Bluff Rhyolite of Berry, 1976)

Ya Andesites and basalts (west of Ironton, equivalent to Buck Mountain Shut-ins Formation of Berry, 1976)

Yt Trachytes

Ys Quartz latites (west of Ironton, includes Shepherd Mountain Rhyolite and informal map unit 690 of Berry, 1976)

A screened version of the geologic map has been used as the base for the map of sample localities, plate 1.

## Preparation and analysis of samples

The samples were pulverized to minus 140 mesh (0.105 mm) in a vertical grinder with ceramic plates.

Major elements were determined by a well-documented X-ray fluorescence technique (Burtin, 1975). Each sample was fused in a platinum-gold alloy crucible using a Claisse fluxer, and was then poured into a 25 mm platinum-gold mold to form a fusion disc. The sample-to-flux ratio was 1:14, the flux consisting of an equal weight of lithium metaborate and sodium borate. The sample discs were compared to discs prepared from accepted standard samples to determine the percentage composition of the various elements. The elements so determined were reported as their oxides.

Thirty-one elements were determined semiquantitatively using a six-step, D.C.-arc, optical-emission spectrographic method (Grimes and Marranzino, 1968). The semiquantitative spectrographic values are reported as six steps per order of magnitude (1, 0.7, 0.5, 0.3, 0.2, 0.15, and multiples of 10 of these numbers) and are approximate geometric midpoints of the concentration ranges. The precision is within one adjoining reporting interval on each side of the reported values for 83 percent of all analyses and within two adjoining intervals on each side of the reported values for 96 percent of all analyses (Motooka and Grimes, 1976).

The visual lower limits of detection for the 31 elements that were determined spectrographically 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 | Molybdenum | 5 |
| Arsenic | 200 | Nickel | 5 |
| Barium | 20 | Niobium | 20 |
| Beryllium | 1 | Scandium | 5 |
| Bismuth | 10 | Silver | 0.5 |
| Boron | 10 | Strontium | 100 |
| Cadmium | 20 | Thorium | 100 |
| Chromium | 10 | Tin | 10 |
| Cobalt | 5 | Tungsten | 50 |
| Copper | 5 | Vanadium | 10 |
| Gold | 10 | Yttrium | 10 |
| Lanthanum | 20 | Zinc | 200 |
| Lead | 10 | Zirconium | 10 |
| Manganese | 5 | | |

Additional chemical methods were used to measure certain elements not determined spectrographically: Li, Na, F, and Hg. Other elements were determined by chemical analysis to obtain lower limits of determination than are obtainable spectrographically. Table 1 summarizes the elements determined, lower limits of determination, analytical method, and the literature reference for the method.

Table 1.--Lower limits of determination, analytical method, and reference to description of method, for selected elements

| Element | Lower limit (ppm) | Method | Reference |
|---|---|---|---|
| Antimony | 1 | Atomic absorption | Welsch and Chao, 1975 |
| Arsenic | 10 | Colorimetric | Ward and others, 1963 |
| Bismuth | 0.5 | Atomic absorption | Viets, 1978 |
| Cadmium | 0.05 | Atomic absorption | Viets, 1978 |
| Copper | 1 | Atomic absorption | Viets, 1978 |
| Fluorine | 100 | Ion-selective electrode | Hopkins, 1977 |
| Lead | 1 | Atomic absorption | Viets, 1978 |
| Lithium | 1 | Atomic absorption | Meier, 1979 |
| Magnesium | 10 | Atomic absorption | Meier, 1979 |
| Mercury | 0.02 | Instrumental | Ward and others, 1969 |
| Silver | 0.05 | Atomic absorption | Viets, 1978 |
| Sodium | 100 | Atomic absorption | Meier, 1979[1/] |
| Tin | 2 | Atomic absorption | Welsch and Chao, 1976 |
| Tungsten | 1 | Colorimetric | Quin and Brooks, 1972[1/] |
| Zinc | 1 | Atomic absorption | Viets, 1978 |

1/ Slight modifications have been made from published method.

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Explanation of table 2

The columns in this table have headings of "sample" and chemical compounds and elements. Each sample number consists of a letter and a number; the letter refers to one of the eight 30' quadrangles within the Rolla 1° X 2° quadrangle (see inset map), and the numbers were assigned in order of collection within each 30' quadrangle, except that samples C94-C108 are from the "D" quadrangle, and samples R025-R030 are from the "C" quadrangle.

The major elements Si, Al, Fe, Ca, K, Ti, and P were determined as oxides by X-ray fluorescence; the two remaining major elements, Mg and Na, were determined as elements by atomic absorption and were converted mathematically to equivalent oxide values. For the remaining elements, the prefix S in the column heading indicates analysis by emission spectrograph, AA by atomic absorption, CM by colorimetry, INST by mercury analizer, and SI by ion-selective electrode. Values for the nine major oxides and the emission spectrographic values for Fe, Mg, Ca, and Ti are reported in percent; all other values are in parts per million (ppm). Other symbols used in the table are:

N = Not detected at lower limit of detection

— = Not determined

< = Detected, but below the value shown

> = Greater than value shown

Elements that were not detected in any of the samples are not listed.

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri

| sample | | SIO2% | AL203% | FE203% | MGO% | CAO% | NA20% | K20% | TIO2% | P205% | S-FE% | S-MG% | S-CA% | S-TI% | S-MN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | Yt | 61.3 | 13.50 | 8.10 | 2.13 | 2.70 | 3.10 | 4.13 | 1.23 | .26 | 5.0 | 1.00 | 1.00 | .50 | 1,000 |
| B3 | Ygh | 75.8 | 11.60 | 1.80 | .13 | .28 | 3.20 | 4.86 | .29 | .01 | 1.0 | .07 | .07 | .10 | 200 |
| B5 | Ys | 74.1 | 12.80 | 2.30 | .53 | 1.40 | 2.80 | 5.60 | .38 | .06 | 1.5 | .30 | .70 | .20 | 1,000 |
| B8 | Yar | 75.3 | 13.50 | 2.20 | .15 | .17 | 1.80 | 6.77 | .35 | <.01 | 1.5 | .10 | .05 | .15 | 200 |
| B9 | Yar | 75.6 | 12.10 | 1.90 | .22 | .27 | 1.20 | 7.36 | .35 | .01 | 1.0 | .15 | .07 | .15 | 500 |
| B10 | Yr | 75.5 | 11.90 | 3.50 | .17 | .81 | 3.60 | 4.32 | .29 | .03 | 2.0 | .07 | .20 | .15 | 500 |
| C1 | Ys | 68.9 | 12.20 | 2.60 | .17 | .37 | 3.00 | 7.03 | .30 | .01 | 1.5 | .07 | .15 | .20 | 500 |
| C7 | Yarr | 79.9 | 11.70 | 2.70 | .07 | .58 | 1.80 | 7.14 | .31 | <.01 | 2.0 | .03 | .15 | .10 | 700 |
| C8 | Yarb | 68.2 | 12.10 | 3.40 | .17 | .24 | 2.20 | 6.34 | .28 | .02 | 3.0 | .10 | .05 | .15 | 500 |
| C10 | Ys | 70.4 | 13.70 | 2.70 | .15 | .46 | 2.30 | 8.23 | .54 | .07 | 2.0 | .10 | .15 | .30 | 300 |
| C13 | Yart | 74.7 | 11.20 | 2.60 | .05 | .34 | 2.30 | 6.34 | .24 | <.01 | 1.5 | .02 | .10 | .15 | 700 |
| C14 | Yag | 80.1 | 11.30 | 2.50 | .07 | .54 | 3.40 | 4.80 | .30 | <.01 | 2.0 | .05 | .20 | .15 | 1,000 |
| C16 | Yar | 70.6 | 13.70 | 3.40 | .08 | .12 | .14 | 12.20 | .30 | .01 | 2.0 | .05 | <.05 | .20 | 70 |
| C23 | Ys | 74.6 | 12.80 | 2.00 | .38 | .38 | 2.60 | 7.30 | .16 | <.01 | 1.5 | .07 | .10 | .07 | 150 |
| C27 | Yag | 74.7 | 11.60 | 2.80 | .22 | .35 | 4.30 | 4.87 | .27 | .01 | 2.0 | .07 | .15 | .15 | 1,500 |
| C29 | Yar | 77.7 | 11.30 | 2.20 | .03 | .26 | 2.60 | 6.02 | .18 | <.01 | 2.0 | <.02 | .07 | .10 | 500 |
| C36 | Yag | 74.5 | 11.40 | 2.70 | .22 | .39 | 3.40 | 4.90 | .30 | <.01 | 2.0 | .15 | .15 | .15 | 1,500 |
| C37 | Yar | 70.3 | 12.70 | 3.40 | .15 | .94 | 4.30 | 4.87 | .58 | .03 | 3.0 | .10 | .30 | .20 | 2,000 |
| C51 | Yar | 70.7 | 12.60 | 3.50 | .03 | .16 | 1.50 | 9.87 | .44 | .02 | 3.0 | <.02 | .05 | .20 | 300 |
| C52 | Yag | 79.5 | 11.70 | 2.40 | .10 | .37 | 3.40 | 5.21 | .25 | <.01 | 2.0 | .07 | .15 | .10 | 1,000 |
| C60 | Yarr | 74.4 | 11.80 | 2.70 | .10 | .09 | .14 | 8.56 | .29 | <.01 | 2.0 | .10 | <.05 | .15 | 500 |
| C64 | Yar | 78.4 | 11.30 | 3.20 | .05 | .34 | 2.60 | 6.23 | .25 | <.01 | 3.0 | .02 | .15 | .15 | 1,000 |
| C66 | Yar | 75.5 | 11.20 | 2.40 | .07 | .12 | 1.10 | 8.35 | .24 | <.01 | 1.5 | .02 | <.05 | .10 | 300 |
| C73 | Yag | 79.0 | 11.30 | 3.30 | .25 | .61 | 2.00 | 5.11 | .46 | .04 | 2.0 | .15 | .30 | .20 | 1,000 |
| C74 | Yag | 85.8 | 10.10 | 2.60 | .07 | .08 | 2.20 | 3.34 | .23 | <.01 | 2.0 | .05 | .10 | .15 | 500 |
| C79 | Yar | 79.9 | 12.20 | 2.50 | .10 | .30 | .14 | 5.76 | .20 | <.01 | 2.0 | .03 | N | .15 | 500 |
| C80 | Yar | 73.8 | 11.60 | 2.40 | .03 | .29 | 1.60 | 5.69 | .21 | <.01 | 2.0 | .02 | .10 | .10 | 300 |
| C81 | Yar | 77.4 | 11.30 | 2.10 | .10 | .22 | .27 | 7.87 | .17 | <.01 | 2.0 | .05 | .10 | .10 | 1,000 |
| C84 | Yar | 65.5 | 11.60 | 3.00 | .25 | 1.18 | 5.10 | 3.85 | .35 | .04 | 3.0 | .20 | .70 | .20 | 1,000 |
| C85 | Ys | 75.4 | 11.80 | 1.60 | .23 | .31 | 3.90 | 5.11 | .22 | <.01 | 1.0 | .20 | .15 | .15 | 200 |
| C86 | Yr | 71.2 | 12.60 | 3.80 | .30 | 1.03 | 4.10 | 5.11 | .51 | .04 | 7.0 | .20 | .70 | .20 | 1,000 |
| C87 | Ys | 77.1 | 12.00 | 2.20 | .13 | .17 | 4.20 | 4.87 | .25 | <.01 | 1.5 | .10 | .05 | .10 | 300 |
| C89 | Yag | 75.5 | 11.70 | 2.40 | .15 | .31 | 3.90 | 5.10 | .38 | <.01 | 2.0 | .10 | .10 | .15 | 1,000 |
| C90 | Yart | 77.7 | 11.70 | 3.40 | .12 | .10 | 1.40 | 7.02 | .28 | <.01 | 3.0 | .07 | <.05 | .10 | 150 |
| C91 | Yar | 77.8 | 11.50 | 3.50 | .22 | .12 | .54 | 8.74 | .26 | <.01 | 3.0 | .15 | <.05 | .10 | 500 |
| C92 | Yar | 72.1 | 12.40 | 2.70 | .15 | .10 | .14 | 11.05 | .22 | <.01 | 2.0 | .10 | <.05 | .15 | 200 |
| C93 | Ygm | 68.0 | 12.10 | 4.60 | 1.05 | 1.80 | 4.20 | 3.93 | .89 | .19 | 5.0 | .70 | 1.00 | .30 | 1,000 |
| C94 | Yag | 76.3 | 11.30 | 2.20 | .10 | .23 | 3.90 | 4.59 | .41 | <.01 | 1.5 | .03 | .10 | .10 | 1,000 |
| C97 | Yag | 76.4 | 12.90 | 1.40 | .42 | .85 | 3.10 | 2.46 | .40 | .06 | 1.0 | .30 | 1.50 | .15 | 200 |
| C98 | Yr | 63.7 | 15.00 | 5.40 | 2.26 | 3.06 | 5.90 | 2.30 | .74 | .17 | 5.0 | 1.50 | 1.50 | .20 | 700 |
| C99 | Yar | 82.6 | 12.60 | 1.30 | .08 | .64 | 3.40 | 5.03 | .20 | <.01 | .7 | .05 | .50 | .07 | 500 |
| C100 | Ys | 64.0 | 15.00 | 3.80 | 2.56 | 3.37 | 5.50 | 3.94 | .63 | .18 | 3.0 | 1.00 | 2.00 | .30 | 700 |
| C101 | Ys | 67.8 | 14.20 | 5.30 | .76 | 1.71 | 6.20 | 3.05 | .64 | .17 | 5.0 | .50 | 1.00 | .30 | 500 |
| C103 | Ys | 74.0 | 12.80 | 2.10 | .28 | 1.38 | 4.90 | 2.80 | .41 | .05 | 1.5 | .20 | 1.00 | .20 | 300 |
| C104 | Ys | 66.2 | 13.00 | 5.50 | 1.10 | 2.30 | 5.90 | 2.32 | 1.05 | .29 | 7.0 | .70 | 1.00 | .50 | 700 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO | S-NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | Yt | N | N | N | 30 | 1,500 | 2.0 | N | N | 50 | 20 | 70 | 70 | N | N |
| B3 | Ygh | N | N | N | 10 | 700 | 1.5 | N | N | N | <10 | N | 50 | N | N |
| B5 | Ys | N | N | N | 20 | 700 | 2.0 | N | N | 5 | 50 | N | 50 | N | <20 |
| B8 | Yar | N | N | N | 50 | 700 | 1.0 | N | N | 7 | <10 | N | 30 | 5 | <20 |
| B9 | Yar | N | N | N | 15 | 1,000 | <1.0 | N | N | 5 | <10 | 5 | 50 | 5 | N |
| B10 | Yr | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | N | 100 | <5 | <20 |
| C1 | Ys | N | N | N | 10 | 1,500 | 1.0 | N | N | 5 | <10 | N | 100 | N | <20 |
| C7 | Yarr | N | N | N | 10 | 300 | 2.0 | N | N | <5 | <10 | 5 | 100 | N | <20 |
| C8 | Yarb | N | N | N | 30 | 1,000 | 1.5 | N | N | 7 | <10 | <5 | 70 | N | <20 |
| C10 | Ys | N | N | N | 50 | 2,000 | 1.0 | N | N | N | <10 | <5 | 30 | 20 | N |
| C13 | Yart | N | N | N | <10 | 300 | 2.0 | N | N | N | <10 | N | 70 | N | <20 |
| C14 | Yag | <.5 | N | N | 15 | 300 | 3.0 | N | N | N | 10 | 7 | 100 | 10 | <20 |
| C16 | Yar | N | N | N | 10 | 2,000 | 1.0 | N | N | N | <10 | N | 70 | N | <20 |
| C23 | Ys | <.5 | N | N | 10 | 1,500 | 1.5 | N | N | N | <10 | N | 20 | N | <20 |
| C27 | Yag | N | N | N | 20 | 300 | 2.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| C29 | Yar | N | N | N | 20 | 150 | 3.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| C36 | Yag | 1.0 | N | N | 10 | 300 | 2.0 | N | N | N | <10 | N | 100 | N | <20 |
| C37 | Yar | N | N | N | 10 | 1,000 | 1.0 | N | N | N | <10 | N | 70 | N | <20 |
| C51 | Yar | 1.5 | N | N | 10 | 1,500 | 1.0 | N | N | N | <10 | N | 70 | 20 | <20 |
| C52 | Yag | N | N | N | 10 | 300 | 2.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| C60 | Yarr | N | N | N | 50 | 500 | 1.0 | N | N | N | <10 | 7 | 100 | 5 | <20 |
| C64 | Yar | N | N | N | 10 | 150 | 1.5 | N | N | N | <10 | N | 100 | N | <20 |
| C66 | Yar | N | N | N | 10 | 300 | 1.0 | N | N | N | 10 | 15 | 50 | N | <20 |
| C73 | Yag | 3.0 | N | N | 20 | 700 | 5.0 | N | N | N | <10 | <5 | 100 | 15 | <20 |
| C74 | Yag | N | N | N | 30 | 500 | 1.5 | N | N | N | <10 | N | 70 | 10 | <20 |
| C79 | Yar | .5 | N | N | 100 | 200 | 2.0 | N | N | N | 10 | <5 | 70 | N | <20 |
| C80 | Yar | N | N | N | 15 | 300 | 2.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| C81 | Yar | .7 | N | N | 20 | 300 | 2.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| C84 | Yar | N | N | N | <10 | 1,000 | 1.5 | N | N | N | 10 | 5 | 100 | 5 | N |
| C85 | Ys | .7 | N | N | 10 | 1,000 | 2.0 | N | N | N | <10 | <5 | 100 | N | N |
| C86 | Yr | 1.0 | N | N | 20 | 1,500 | 3.0 | N | N | <5 | <10 | 10 | 100 | 7 | <20 |
| C87 | Ys | N | N | N | 10 | 700 | 1.5 | N | N | N | <10 | <5 | 100 | N | <20 |
| C89 | Yag | N | N | N | <10 | 500 | 1.0 | N | N | N | 20 | 5 | 100 | 7 | N |
| C90 | Yart | N | N | N | 20 | 1,500 | 1.0 | N | N | 5 | <10 | N | 20 | N | <20 |
| C91 | Yar | N | N | N | <10 | 1,500 | 1.5 | N | N | 10 | <10 | <5 | <20 | N | <20 |
| C92 | Yar | N | N | N | 10 | 2,000 | 1.5 | N | N | 7 | <10 | 10 | 200 | 5 | 20 |
| C93 | Ygm | N | N | N | <10 | 500 | 2.0 | N | N | 10 | <10 | 10 | 70 | 5 | <20 |
| C94 | Yag | N | N | N | <10 | 200 | 3.0 | N | N | N | <10 | <5 | 150 | N | <20 |
| C97 | Yag | N | N | N | 30 | 500 | 1.5 | N | N | 5 | <10 | N | 50 | N | N |
| C98 | Yr | N | N | N | 15 | 700 | 1.0 | N | N | 20 | 100 | N | 30 | N | N |
| C99 | Yar | N | N | N | 10 | 500 | 2.0 | N | N | N | <10 | 5 | 70 | N | <20 |
| C100 | Ys | N | N | N | 15 | 2,000 | 1.0 | N | N | 20 | 100 | N | 20 | N | N |
| C101 | Ys | N | N | N | <10 | 1,500 | 1.5 | N | N | 10 | 20 | N | 50 | N | N |
| C103 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | <5 | 70 | N | N |
| C104 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | 10 | <10 | N | 70 | N | <20 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | S-GE | AA-CU-P | AA-PB-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | Yt | 20 | 20 | N | 20 | N | 200 | 150 | N | 70 | N | 200 | N | -- | -- |
| B3 | Ygh | <5 | 30 | N | 7 | N | N | <10 | N | 70 | N | 200 | N | -- | -- |
| B5 | Ys | 10 | 30 | N | 10 | 10 | 100 | 70 | N | 150 | N | 150 | N | -- | -- |
| B8 | Yar | 10 | 30 | N | 7 | N | <100 | 15 | N | 100 | N | 150 | N | -- | -- |
| B9 | Yar | 5 | 20 | N | 5 | N | <100 | <10 | N | 70 | N | 150 | N | -- | -- |
| B10 | Yr | <5 | 10 | N | 7 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| C1 | Ys | <5 | 10 | N | 7 | N | <100 | 10 | N | 50 | N | 200 | N | 5 | <5 |
| C7 | Yarr | 5 | 30 | N | 5 | N | <100 | <10 | N | 100 | N | 300 | N | 10 | 10 |
| C8 | Yarb | <5 | 20 | N | 10 | N | 100 | 10 | N | 70 | N | 300 | N | 5 | 5 |
| C10 | Ys | 5 | 10 | N | 10 | N | 100 | 30 | N | 30 | N | 150 | N | 5 | <5 |
| C13 | Yart | <5 | 50 | N | 7 | N | <100 | <10 | N | 70 | N | 300 | N | 5 | 5 |
| C14 | Yag | 7 | 50 | N | 10 | <10 | <100 | <10 | N | 100 | N | 300 | N | 5 | 5 |
| C16 | Yar | <5 | 10 | N | 10 | N | <100 | 10 | N | 100 | N | 200 | N | 5 | <5 |
| C23 | Ys | 5 | 10 | N | 5 | 10 | 100 | <10 | N | 50 | N | 100 | N | 5 | <5 |
| C27 | Yag | 5 | 30 | N | 10 | N | <100 | <10 | N | 70 | <200 | 200 | N | <5 | <5 |
| C29 | Yar | 5 | 50 | N | 5 | N | <100 | <10 | N | 100 | N | 300 | N | <5 | <5 |
| C36 | Yag | 5 | 30 | N | 10 | <10 | <100 | <10 | N | 100 | N | 200 | N | <5 | 15 |
| C37 | Yar | <5 | 20 | N | 30 | N | <100 | <10 | N | 100 | N | 200 | N | <5 | <5 |
| C51 | Yar | 5 | 20 | N | 20 | N | 100 | <10 | <50 | 70 | N | 200 | N | N | <5 |
| C52 | Yag | <5 | 30 | N | 7 | N | <100 | <10 | N | 100 | N | 300 | N | <5 | 5 |
| C60 | Yarr | <5 | 50 | N | 7 | N | <100 | 10 | N | 150 | N | 300 | N | <5 | 10 |
| C64 | Yar | <5 | 15 | N | 5 | N | <100 | <10 | N | 100 | N | 300 | N | <5 | <5 |
| C66 | Yar | 5 | 20 | N | 5 | <10 | <100 | <10 | N | 70 | N | 300 | N | 10 | 5 |
| C73 | Yag | 5 | 50 | N | 15 | N | <100 | 10 | N | 100 | 200 | 500 | N | <5 | 5 |
| C74 | Yag | <5 | 20 | N | 10 | N | <100 | <10 | N | 70 | N | 300 | N | <5 | 5 |
| C79 | Yar | 5 | 10 | N | 7 | N | <100 | 10 | N | 70 | N | 500 | N | 25 | <5 |
| C80 | Yar | 5 | 20 | N | 7 | <10 | 100 | <10 | N | 70 | N | 300 | N | <5 | <5 |
| C81 | Yar | 5 | 20 | N | 7 | N | <100 | 10 | N | 50 | N | 200 | N | <5 | <5 |
| C84 | Yar | 5 | 30 | N | 15 | N | 100 | 10 | N | 100 | N | 150 | N | <5 | 10 |
| C85 | Ys | 5 | 10 | N | 5 | <10 | 100 | 15 | N | 50 | N | 150 | N | N | <5 |
| C86 | Yr | 5 | 50 | N | 15 | 10 | 100 | 10 | N | 150 | N | 500 | N | <5 | 10 |
| C87 | Ys | 5 | N | N | 7 | 10 | <100 | <10 | N | 70 | N | 150 | N | <5 | <5 |
| C89 | Yag | 7 | 70 | N | 10 | <10 | <100 | <10 | N | 100 | N | 200 | N | -- | -- |
| C90 | Yart | <5 | 10 | N | 10 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| C91 | Yar | <5 | 15 | N | 5 | N | <100 | <10 | N | 50 | N | 300 | N | -- | -- |
| C92 | Yar | <5 | 10 | N | 10 | N | <100 | <10 | N | 100 | N | 500 | N | -- | -- |
| C93 | Ygm | <5 | 20 | N | 20 | N | 150 | 70 | N | 100 | N | 300 | N | -- | -- |
| C94 | Yag | <5 | 20 | N | 7 | 10 | N | <10 | N | 150 | N | 300 | N | -- | -- |
| C97 | Yag | 7 | <10 | N | 5 | N | 300 | 30 | N | 20 | N | 100 | N | -- | -- |
| C98 | Yr | 70 | 10 | N | 20 | N | 500 | 70 | N | 20 | N | 70 | N | -- | -- |
| C99 | Yar | 5 | 50 | N | 5 | N | 100 | <10 | N | 50 | N | 150 | N | -- | -- |
| C100 | Ys | 70 | 10 | N | 20 | N | 500 | 100 | N | 20 | N | 100 | N | -- | -- |
| C101 | Ys | 10 | 10 | N | 20 | N | 200 | 50 | N | 70 | N | 200 | N | -- | -- |
| C103 | Ys | 5 | N | N | 10 | N | 300 | 20 | N | 50 | N | 200 | N | -- | -- |
| C104 | Ys | 5 | 10 | N | 20 | N | 300 | 70 | N | 70 | N | 150 | N | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | AA-ZN-P | AA-AG-P | AA-CD-P | AA-BI-P | AA-SB-P | AA-SN-P | AA-LI | CM-AS | CM-W-P | INST-HG | SI-F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | Yt | -- | -- | -- | -- | -- | -- | 32 | -- | -- | -- | -- |
| B3 | Ygh | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| B5 | Ys | -- | -- | -- | -- | -- | -- | 9 | -- | -- | -- | -- |
| B8 | Yar | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| B9 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| B10 | Yr | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| C1 | Ys | 25 | .10 | .05 | <.5 | N | N | 2 | N | <1 | .18 | 560 |
| C7 | Yarr | 30 | .60 | .15 | <.5 | N | N | 4 | N | 1 | .22 | 1,080 |
| C8 | Yarb | 5 | 1.30 | <.05 | <.5 | N | N | 3 | <10 | <1 | .24 | 580 |
| C10 | Ys | 10 | .10 | .05 | <.5 | N | N | 4 | N | 1 | .10 | 800 |
| C13 | Yart | <5 | .30 | <.05 | <.5 | N | N | 2 | 30 | 1 | .12 | 940 |
| C14 | Yag | 50 | .15 | <.05 | <.5 | N | N | 7 | <10 | 1 | .20 | 760 |
| C16 | Yar | <5 | .25 | <.05 | <.5 | N | N | 2 | N | 1 | .16 | 500 |
| C23 | Ys | 5 | .60 | <.05 | <.5 | N | 2 | 2 | N | 1 | .14 | 400 |
| C27 | Yag | 20 | .15 | <.05 | <.5 | N | N | 5 | N | <1 | .30 | 460 |
| C29 | Yar | 10 | .05 | <.05 | <.5 | N | N | 1 | N | 1 | .14 | 1,260 |
| C36 | Yag | 60 | .45 | <.05 | <.5 | N | N | 3 | N | N | .16 | 860 |
| C37 | Yar | 30 | .15 | <.05 | <.5 | 2 | N | 8 | <10 | 1 | .12 | 680 |
| C51 | Yar | 10 | .20 | <.05 | <.5 | 1 | N | 1 | N | <1 | .08 | 340 |
| C52 | Yag | 60 | .20 | .05 | <.5 | N | N | 1 | N | <1 | .12 | 1,200 |
| C60 | Yarr | 5 | .25 | <.05 | <.5 | N | N | 5 | N | 3 | .10 | 4,200 |
| C64 | Yar | 35 | .45 | .05 | <.5 | N | N | 1 | N | <1 | .12 | 650 |
| C66 | Yar | 45 | .55 | <.05 | <.5 | N | N | 1 | N | 2 | .30 | 520 |
| C73 | Yag | 15 | .75 | <.05 | <.5 | N | N | 19 | <10 | 2 | .12 | 2,000 |
| C74 | Yag | 5 | .55 | <.05 | <.5 | N | N | 3 | <10 | 3 | .14 | 520 |
| C79 | Yar | <5 | .60 | <.05 | <.5 | N | N | 9 | 60 | 3 | .12 | 1,160 |
| C80 | Yar | 5 | 3.00 | <.05 | <.5 | N | N | 3 | 30 | 1 | .14 | 350 |
| C81 | Yar | 5 | .25 | <.05 | <.5 | N | N | 12 | 10 | 2 | .06 | 540 |
| C84 | Yar | 50 | .50 | <.05 | <.5 | N | N | 3 | <10 | 1 | .22 | 1,160 |
| C85 | Ys | <5 | .35 | <.05 | <.5 | N | N | 2 | <10 | 1 | .10 | 630 |
| C86 | Yr | 90 | .40 | .05 | <.5 | N | 1 | 6 | <10 | <1 | .20 | 2,000 |
| C87 | Ys | 35 | 1.70 | <.05 | <.5 | N | 2 | 2 | N | 1 | .22 | 376 |
| C89 | Yag | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| C90 | Yart | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C91 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C92 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C93 | Ygm | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| C94 | Yag | -- | -- | -- | -- | -- | -- | 6 | -- | -- | -- | -- |
| C97 | Yag | -- | -- | -- | -- | -- | -- | 6 | -- | -- | -- | -- |
| C98 | Yr | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| C99 | Yar | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| C100 | Ys | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C101 | Ys | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| C103 | Ys | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C104 | Ys | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | SIO2% | AL2O3% | FE2O3% | MGO% | CAO% | NA2O% | K2O% | TIO2% | P2O5% | $-FE% | $-MG% | $-CA% | $-TI% | $-MN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C105 | Ygm | 69.0 | 13.30 | 3.30 | .83 | 1.89 | 4.60 | 3.75 | .47 | .10 | 3.0 | .50 | 1.00 | .20 | 700 |
| C106A | Ygm | 68.4 | 13.40 | 3.50 | .86 | 1.96 | 4.20 | 3.95 | .71 | .12 | 3.0 | 1.00 | 1.50 | .30 | 1,000 |
| C107A | Yar | 60.8 | 14.80 | 3.40 | .03 | .17 | 1.10 | 11.63 | .24 | <.01 | 3.0 | .02 | .05 | .20 | 200 |
| C109 | Ya | 63.3 | 13.60 | 7.60 | 1.71 | 2.31 | 2.70 | 5.89 | 1.30 | .24 | 10.0 | 1.00 | 1.50 | 1.00 | 700 |
| C112 | Yar | 75.6 | 12.70 | 2.30 | .28 | .33 | .41 | 9.94 | .35 | .02 | 3.0 | .30 | .20 | .20 | 700 |
| C114 | Yr | 71.3 | 13.20 | 3.60 | .35 | .80 | 4.70 | 3.64 | .59 | .10 | 5.0 | .30 | .50 | .30 | 1,000 |
| C115 | Yag | 77.4 | 11.00 | 3.20 | .03 | .12 | .95 | 7.60 | .26 | <.01 | 3.0 | .02 | <.05 | 1.00 | 50 |
| C117 | Ys | 71.4 | 12.30 | 2.00 | .18 | .42 | 3.80 | 4.73 | .33 | <.01 | 2.0 | .10 | .20 | .15 | 700 |
| C119 | Yag | 71.0 | 12.00 | 2.80 | .10 | .38 | 3.90 | 4.67 | .47 | .01 | 3.0 | .07 | .20 | .20 | 2,000 |
| C121 | Yar | 74.4 | 12.30 | 2.40 | .07 | .41 | 6.90 | .43 | .42 | .01 | 2.0 | .03 | .20 | .15 | 200 |
| C127 | Yar | 67.0 | 11.40 | 3.20 | .05 | .08 | .81 | 8.55 | .34 | <.01 | 3.0 | .02 | <.05 | .10 | 300 |
| C129 | Yari | 79.2 | 11.30 | 2.90 | .18 | .43 | 3.50 | 5.06 | .26 | <.01 | 2.0 | .10 | .20 | .15 | 700 |
| C130 | Yr | 62.2 | 12.10 | 2.60 | .33 | .59 | 3.90 | 4.86 | .52 | .04 | 2.0 | .20 | .30 | .20 | 700 |
| C131 | Yar | 67.0 | 13.20 | 3.60 | .05 | .18 | 1.80 | 8.00 | .35 | .01 | 5.0 | .02 | .05 | .20 | 700 |
| C132 | Yar | 76.7 | 12.40 | 2.30 | .07 | .12 | 2.60 | 6.04 | .27 | <.01 | 2.0 | .03 | <.05 | .15 | 300 |
| D10 | Yag | 76.2 | 11.60 | 2.00 | .10 | .12 | 3.90 | 4.35 | .36 | <.01 | 2.0 | .05 | .05 | .20 | 500 |
| D12 | Yar | 72.7 | 14.40 | 4.00 | .61 | 1.52 | 5.10 | 5.03 | .72 | .14 | 3.0 | .50 | 1.00 | .50 | 2,000 |
| D13 | Yar | 71.2 | 11.50 | 2.70 | .13 | .25 | 3.80 | 5.35 | .39 | .01 | 3.0 | .10 | .15 | .20 | 700 |
| D18 | Yar | 78.7 | 11.70 | 2.20 | .05 | .17 | 3.90 | 4.65 | .28 | <.01 | 2.0 | .02 | .05 | .15 | 1,000 |
| D21 | Ya | 63.3 | 14.80 | 6.00 | 2.24 | 3.76 | 3.40 | 3.72 | .71 | .19 | 5.0 | 2.00 | 2.00 | .50 | 1,000 |
| D23 | Ygg | 79.5 | 12.00 | 1.10 | .05 | .15 | 3.50 | 4.69 | .17 | <.01 | .7 | .03 | .05 | .07 | 300 |
| D24 | Ygh | 75.1 | 12.30 | 2.00 | .13 | .74 | 4.20 | 4.91 | .16 | <.01 | 1.5 | .10 | .50 | .10 | 500 |
| D25 | Ygh | 72.2 | 11.60 | 1.50 | .12 | .97 | 3.00 | 5.20 | .33 | .03 | 1.0 | .10 | .70 | .15 | 500 |
| D26A | Ys | 71.4 | 14.00 | 3.00 | .15 | 1.23 | 5.30 | 3.44 | .70 | .09 | 3.0 | .10 | .70 | .30 | 700 |
| D27A | Yar | 70.9 | 11.30 | 2.10 | .05 | .42 | 3.00 | 6.19 | .38 | <.01 | 1.5 | .03 | .20 | .15 | 1,000 |
| D33 | Yar | 78.2 | 12.20 | 2.90 | .03 | .09 | 4.70 | 3.81 | .27 | <.01 | 2.0 | .02 | <.05 | .15 | 200 |
| D34 | Yar | 73.2 | 12.90 | 4.40 | .37 | 1.29 | 3.50 | 6.06 | .51 | .14 | 5.0 | .30 | .70 | .30 | 1,500 |
| D35 | Yar | 75.1 | 12.10 | 2.70 | .10 | .79 | 3.60 | 5.36 | .32 | <.01 | 2.0 | .05 | .50 | .15 | 1,000 |
| D39 | Yar | 74.3 | 12.10 | 2.80 | .30 | .60 | 4.90 | 3.98 | .32 | .03 | 2.0 | .20 | .30 | .20 | 1,000 |
| D40 | Ygg | 80.0 | 11.00 | 1.40 | .03 | .14 | 3.80 | 4.23 | .17 | <.01 | 1.0 | .02 | .05 | .05 | 150 |
| F1 | Yar | 72.3 | 13.20 | 2.30 | .03 | .08 | .14 | 11.10 | .26 | <.01 | 2.0 | <.02 | <.05 | .15 | 150 |
| F3 | Yar | 72.5 | 14.00 | 3.00 | .08 | .09 | .27 | 11.58 | .36 | .02 | 2.0 | .05 | <.05 | .20 | 500 |
| F5 | Yar | 69.9 | 13.90 | 3.10 | .05 | .17 | .27 | 11.10 | .37 | .03 | 3.0 | .02 | .05 | .20 | 300 |
| F7 | Yar | 76.3 | 11.70 | 2.20 | .07 | .08 | .14 | 8.52 | .21 | .01 | 2.0 | .05 | <.05 | .15 | 150 |
| F8 | Yar | 72.7 | 12.20 | 3.00 | .05 | .12 | .27 | 9.90 | .44 | .04 | 3.0 | .02 | <.05 | .20 | 300 |
| F9 | Yar | 78.1 | 12.10 | 2.20 | .08 | .08 | .68 | 8.72 | .24 | <.01 | 1.5 | .05 | <.05 | .15 | 200 |
| F10 | Yar | 70.9 | 12.20 | 2.70 | .08 | .10 | .14 | 9.62 | .35 | .02 | 3.0 | .05 | <.05 | .20 | 200 |
| F11 | Yar | 64.3 | 13.50 | 7.40 | .30 | .23 | .14 | 9.22 | .65 | .14 | 7.0 | .20 | .10 | .50 | 700 |
| F12 | Yar | 77.9 | 11.80 | 3.20 | .12 | .13 | .27 | 8.56 | .39 | .04 | 3.0 | .10 | .05 | .20 | 500 |
| G7 | Yag | 75.8 | 12.00 | 2.80 | .23 | .25 | 3.50 | 5.80 | .49 | .01 | 3.0 | .15 | .10 | .20 | 1,500 |
| G9 | Yar | 75.8 | 12.20 | 2.20 | .10 | .75 | 3.50 | 5.10 | .26 | <.01 | 2.0 | .05 | .70 | .10 | 1,000 |
| G21 | Yr | 75.9 | 12.80 | 3.20 | .18 | .46 | 3.50 | 4.81 | .37 | .02 | 3.0 | .10 | .20 | .20 | 500 |
| G23 | Yr | 71.4 | 12.00 | 2.00 | .12 | .14 | 3.10 | 5.80 | .53 | .01 | 2.0 | .10 | .05 | .30 | 200 |
| G29 | Yr | 71.1 | 12.10 | 3.10 | .17 | .47 | 3.20 | 5.85 | .34 | .01 | 3.0 | .10 | .20 | .30 | 700 |
| G31 | Yar | 65.2 | 10.00 | 1.80 | .03 | .27 | 4.00 | 4.07 | .13 | .04 | 2.0 | .02 | .10 | .10 | 500 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO | S-NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C105 | Ygm | N | N | N | 30 | 700 | 1.5 | N | N | 7 | <10 | 5 | 30 | N | N |
| C106A | Ygm | N | N | N | 50 | 1,000 | 1.0 | N | N | 10 | <10 | 20 | 50 | N | <20 |
| C107A | Yar | 1.0 | N | N | 10 | 1,500 | 1.0 | N | N | N | <10 | <5 | 70 | 7 | <20 |
| C109 | Ya | N | N | N | 20 | 1,000 | 1.0 | N | N | 20 | 20 | N | <20 | N | <20 |
| C112 | Yar | N | N | N | 15 | 2,000 | 1.0 | N | N | 5 | <10 | <5 | 50 | N | N |
| C114 | Yr | N | N | N | 10 | 1,000 | 2.0 | N | N | N | <10 | <5 | 50 | N | <20 |
| C115 | Yag | N | N | N | 10 | 1,500 | 2.0 | N | N | N | <10 | 30 | 70 | N | <20 |
| C117 | Ys | N | N | N | 10 | 700 | 3.0 | N | N | N | <10 | 5 | 100 | N | 20 |
| C119 | Yag | N | N | N | 10 | 300 | 3.0 | N | N | N | <10 | <5 | 100 | N | 20 |
| C121 | Yar | N | N | N | <10 | 100 | 1.5 | N | N | N | <10 | <5 | 30 | 10 | <20 |
| C127 | Yar | N | N | N | 15 | 700 | 1.0 | N | N | N | <10 | 5 | 20 | N | 20 |
| C129 | Yari | N | N | N | 10 | 200 | 1.0 | N | N | N | <10 | 5 | 100 | N | 20 |
| C130 | Yr | N | N | N | 30 | 1,000 | 2.0 | N | N | 7 | <10 | <5 | 50 | N | <20 |
| C131 | Yar | N | N | N | 50 | 2,000 | 1.5 | N | N | N | <10 | 5 | 100 | N | <20 |
| C132 | Yar | N | N | N | 20 | 1,000 | 3.0 | N | N | N | <10 | 5 | 100 | N | <20 |
| D10 | Yag | 1.0 | N | N | 50 | 200 | 3.0 | N | N | N | <10 | 5 | 70 | 7 | 20 |
| D12 | Yar | N | N | N | 10 | 3,000 | 2.0 | N | N | 7 | 15 | 7 | 70 | 20 | <20 |
| D13 | Yar | N | N | N | 15 | 1,000 | 2.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| D18 | Yar | N | N | N | 20 | 150 | 3.0 | N | N | N | <10 | N | 70 | N | 20 |
| D21 | Ya | N | N | N | 30 | 1,000 | 1.0 | N | N | 30 | 100 | 50 | 50 | N | N |
| D23 | Ygg | <.5 | N | N | 20 | 200 | 1.5 | N | N | 5 | <10 | <5 | 70 | N | <20 |
| D24 | Ygh | N | N | N | 15 | 300 | 3.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| D25 | Ygh | 1.5 | N | N | 10 | 1,000 | 2.0 | N | N | 15 | <10 | 50 | 100 | N | <20 |
| D26A | Ys | N | N | N | 10 | 1,000 | 2.0 | N | N | 5 | <10 | 10 | 70 | N | <20 |
| D27A | Yar | N | N | N | 10 | 700 | 2.0 | N | N | <5 | <10 | <5 | 100 | N | <20 |
| D33 | Yar | N | N | N | 10 | 700 | 1.5 | N | N | N | <10 | <5 | 20 | N | <20 |
| D34 | Yar | N | N | N | 10 | 1,500 | 2.0 | N | N | 10 | <10 | 5 | 100 | 5 | <20 |
| D35 | Yar | N | N | N | 10 | 1,000 | 2.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| D39 | Yar | N | N | N | 10 | 1,000 | 2.0 | N | N | 7 | 15 | 30 | 100 | 5 | <20 |
| D40 | Ygg | N | N | N | 10 | 200 | 2.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| F1 | Yar | N | N | N | 15 | 2,000 | <1.0 | N | N | N | <10 | N | 70 | N | <20 |
| F3 | Yar | N | N | N | 15 | 3,000 | 1.0 | N | N | 5 | <10 | N | 70 | N | <20 |
| F5 | Yar | N | N | N | 10 | >5,000 | 1.0 | N | N | <5 | 10 | N | 100 | N | <20 |
| F7 | Yar | N | N | N | 20 | 1,500 | 1.5 | N | N | 5 | <10 | N | 70 | N | <20 |
| F8 | Yar | N | N | N | 15 | 2,000 | 1.0 | N | N | N | 10 | N | 100 | N | <20 |
| F9 | Yar | N | N | N | 20 | 2,000 | 1.5 | N | N | N | 10 | N | 100 | <5 | <20 |
| F10 | Yar | N | N | N | 15 | >5,000 | 1.0 | N | N | N | 10 | N | 50 | N | <20 |
| F11 | Yar | N | N | N | 50 | 1,500 | 2.0 | N | N | 20 | 30 | <5 | 150 | N | <20 |
| F12 | Yar | N | N | N | 20 | 1,000 | 1.0 | N | N | 7 | 20 | 5 | 100 | N | <20 |
| G7 | Yag | .5 | N | N | 10 | 700 | 2.0 | N | N | N | <10 | <5 | 100 | 5 | <20 |
| G9 | Yar | .7 | N | N | 30 | 700 | 1.5 | N | N | N | <10 | N | 70 | N | <20 |
| G21 | Yr | <.5 | N | N | 10 | 1,000 | 2.0 | N | N | N | 10 | <5 | 100 | N | <20 |
| G23 | Yr | N | N | N | 15 | 1,500 | 1.0 | N | N | 5 | <10 | 20 | 150 | N | 20 |
| G29 | Yr | N | N | N | 20 | 1,500 | 3.0 | N | N | 5 | 10 | 20 | 100 | N | <20 |
| G31 | Yar | .5 | N | N | 10 | 300 | 2.0 | N | N | N | <10 | 30 | 100 | N | 20 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | S-GE | AA-CU-P | AA-PB-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C105 | Ygm | 5 | 15 | N | 10 | N | 200 | 50 | N | 20 | N | 100 | N | -- | -- |
| C106A | Ygm | 5 | 10 | N | 20 | N | 200 | 70 | N | 50 | N | 150 | N | -- | -- |
| C107A | Yar | <5 | 70 | N | 10 | N | 100 | 10 | N | 70 | N | 200 | N | -- | -- |
| C109 | Ya | 15 | <10 | N | 50 | N | <100 | 200 | N | 70 | N | 300 | N | -- | -- |
| C112 | Yar | <5 | 30 | N | 10 | N | 100 | 20 | N | 50 | N | 150 | N | -- | -- |
| C114 | Yr | <5 | <10 | N | 20 | N | <100 | 20 | N | 70 | N | 300 | N | -- | -- |
| C115 | Yag | 5 | <10 | N | 7 | N | <100 | 10 | N | 30 | N | 200 | N | -- | -- |
| C117 | Ys | <5 | 10 | N | 7 | N | 100 | 10 | N | 50 | N | 200 | N | -- | -- |
| C119 | Yag | 5 | 30 | N | 10 | N | <100 | <10 | N | 70 | 300 | 300 | N | -- | -- |
| C121 | Yar | 5 | 10 | N | 15 | N | <100 | <10 | N | 30 | N | 200 | N | -- | -- |
| C127 | Yar | 5 | 10 | N | 5 | N | <100 | <10 | N | 70 | N | 300 | N | -- | -- |
| C129 | Yari | <5 | 10 | N | 5 | N | <100 | <10 | N | 70 | N | 500 | N | -- | -- |
| C130 | Yr | <5 | 20 | N | 10 | N | 150 | 15 | N | 50 | N | 200 | N | -- | -- |
| C131 | Yar | 5 | 30 | N | 20 | N | 100 | <10 | N | 70 | N | 300 | N | -- | -- |
| C132 | Yar | 5 | 50 | N | 10 | N | 100 | 10 | N | 70 | N | 300 | N | -- | -- |
| D10 | Yag | 7 | 20 | N | 7 | 10 | N | <10 | N | 70 | N | 500 | N | <5 | 5 |
| D12 | Yar | 15 | 50 | N | 30 | N | 100 | 20 | N | 50 | 200 | 200 | N | <5 | 15 |
| D13 | Yar | 5 | 30 | N | 20 | N | <100 | 10 | N | 50 | N | 300 | N | <5 | 10 |
| D18 | Yar | <5 | 20 | N | 7 | N | N | <10 | N | 70 | N | 500 | N | -- | -- |
| D21 | Ya | 50 | 10 | N | 20 | N | 300 | 200 | N | 30 | N | 150 | N | -- | -- |
| D23 | Ygg | 7 | 20 | N | 5 | 10 | <100 | <10 | N | 50 | N | 150 | N | -- | -- |
| D24 | Ygh | <5 | 20 | N | 5 | N | <100 | <10 | N | 100 | N | 200 | N | -- | -- |
| D25 | Ygh | 5 | 100 | N | 20 | N | 150 | <10 | N | 100 | 300 | 300 | N | -- | -- |
| D26A | Ys | 5 | 20 | N | 20 | N | 150 | 20 | N | 100 | N | 300 | N | -- | -- |
| D27A | Yar | 5 | 30 | N | 10 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| D33 | Yar | 5 | 10 | N | 10 | N | <100 | <10 | N | 70 | N | 300 | N | -- | -- |
| D34 | Yar | 5 | 30 | N | 20 | N | <100 | 50 | N | 100 | N | 300 | N | -- | -- |
| D35 | Yar | 5 | 20 | N | 15 | <10 | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| D39 | Yar | 10 | 10 | N | 20 | N | 100 | 10 | N | 100 | N | 300 | N | -- | -- |
| D40 | Ygg | 5 | 10 | N | 5 | N | <100 | <10 | N | 70 | N | 200 | N | -- | -- |
| F1 | Yar | <5 | 20 | N | 10 | N | <100 | <10 | N | 50 | N | 300 | N | -- | -- |
| F3 | Yar | 7 | 30 | N | 10 | <10 | <100 | 10 | N | 70 | N | 200 | N | -- | -- |
| F5 | Yar | 5 | 30 | N | 15 | N | 100 | 10 | N | 100 | N | 200 | N | -- | -- |
| F7 | Yar | 5 | 15 | N | 10 | N | <100 | 10 | N | 150 | N | 300 | N | -- | -- |
| F8 | Yar | 5 | 10 | N | 15 | N | <100 | 20 | N | 100 | N | 300 | N | -- | -- |
| F9 | Yar | 5 | 20 | N | 10 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| F10 | Yar | 5 | 20 | N | 10 | N | <100 | 10 | N | 100 | N | 300 | N | -- | -- |
| F11 | Yar | 15 | 30 | N | 20 | N | 100 | 70 | <50 | 150 | N | 200 | N | -- | -- |
| F12 | Yar | 7 | 20 | N | 15 | <10 | <100 | 20 | N | 100 | N | 300 | N | -- | -- |
| G7 | Yag | 5 | 100 | N | 15 | N | 100 | <10 | N | 100 | 700 | 300 | N | N | 10 |
| G9 | Yar | <5 | 20 | N | 5 | N | 100 | 20 | N | 100 | N | 300 | N | N | 5 |
| G21 | Yr | 5 | 20 | N | 15 | <10 | 100 | 10 | N | 100 | N | 200 | N | N | <5 |
| G23 | Yr | <5 | 20 | N | 20 | 10 | 100 | 10 | N | 100 | N | 300 | N | N | <5 |
| G29 | Yr | 5 | 30 | N | 20 | N | 100 | 20 | N | 100 | N | 500 | N | N | 5 |
| G31 | Yar | 5 | 20 | N | 7 | <10 | <100 | <10 | N | 100 | N | 300 | N | <5 | <5 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | AA-ZN-P | AA-AG-P | AA-CD-P | AA-BI-P | AA-SB-P | AA-SN-P | AA-LI | CM-AS | CM-W-P | INST-HG | SI-F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C105 | Ygm | -- | -- | -- | -- | -- | -- | 10 | -- | -- | -- | -- |
| C106A | Ygm | -- | -- | -- | -- | -- | -- | 16 | -- | -- | -- | -- |
| C107A | Yar | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| C109 | Ya | -- | -- | -- | -- | -- | -- | 18 | -- | -- | -- | -- |
| C112 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C114 | Yr | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| C115 | Yag | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| C117 | Ys | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| C119 | Yag | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| C121 | Yar | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| C127 | Yar | -- | -- | -- | -- | -- | -- | <1 | -- | -- | -- | -- |
| C129 | Yari | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| C130 | Yr | -- | -- | -- | -- | -- | -- | 9 | -- | -- | -- | -- |
| C131 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| C132 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| D10 | Yag | 20 | .30 | <.05 | <.5 | N | N | 2 | N | 1 | .14 | 880 |
| D12 | Yar | 90 | .95 | .15 | <.5 | N | N | 3 | N | 1 | .26 | 1,100 |
| D13 | Yar | 85 | .70 | <.05 | <.5 | N | 1 | 3 | <10 | 1 | .20 | 1,160 |
| D18 | Yar | -- | -- | -- | -- | -- | -- | 13 | -- | -- | -- | -- |
| D21 | Ya | -- | -- | -- | -- | -- | -- | 16 | -- | -- | -- | -- |
| D23 | Ygg | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D24 | Ygh | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| D25 | Ygh | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| D26A | Ys | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| D27A | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D33 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D34 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D35 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D39 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| D40 | Ygg | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| F1 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| F3 | Yar | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| F5 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| F7 | Yar | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| F8 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| F9 | Yar | -- | -- | -- | -- | -- | -- | 16 | -- | -- | -- | -- |
| F10 | Yar | -- | -- | -- | -- | -- | -- | 9 | -- | -- | -- | -- |
| F11 | Yar | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |
| F12 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| G7 | Yag | 45 | .20 | <.05 | <.5 | N | N | 7 | N | 1 | .12 | 560 |
| G9 | Yar | 10 | .40 | <.05 | <.5 | N | N | 1 | 40 | 1 | .18 | 820 |
| G21 | Yr | 5 | .20 | <.05 | <.5 | N | N | 4 | 10 | <1 | .18 | 680 |
| G23 | Yr | <5 | .40 | <.05 | <.5 | N | N | 2 | 10 | N | .14 | 1,000 |
| G29 | Yr | 5 | .25 | <.05 | <.5 | N | N | 5 | 20 | 1 | .12 | 668 |
| G31 | Yar | 5 | .60 | <.05 | <.5 | N | <1 | 1 | 10 | 1 | .50 | 880 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | SIO2% | AL203% | FE203% | MGO% | CAO% | NA2O% | K2O% | TIO2% | P2O5% | S-FE% | S-MG% | S-CA% | S-TI% | S-MN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G35 | Ys | 51.1 | 10,50 | 2.70 | .10 | .43 | 5.30 | 2.73 | .23 | .01 | 5.0 | .10 | .20 | .20 | 700 |
| G38 | Ys | 63.0 | 13.90 | 5.30 | .03 | 1.14 | 7.20 | 1.63 | .75 | .17 | 5.0 | .03 | .70 | .70 | 700 |
| G39 | Ya | 63.6 | 13.20 | 6.90 | 1.46 | 3.46 | 3.90 | 2.29 | .83 | .32 | 7.0 | 1.50 | 2.00 | .50 | 3,000 |
| G40 | Yr | 73.1 | 12.70 | 4.40 | .53 | 1.98 | 3.90 | 4.28 | .45 | .08 | 5.0 | .50 | 1.50 | .30 | 1,500 |
| G41 | Ya | 34.5 | 9.90 | 9.60 | 2.39 | 3,97 | 4.30 | 1.74 | .90 | .22 | 10.0 | 5.00 | 3.00 | 1.00 | 2,000 |
| G42 | Ys | 62.7 | 11,80 | 2.80 | .35 | .52 | 3.60 | 4.48 | .48 | .02 | 5.0 | .07 | .30 | .30 | 1,000 |
| G46 | Yag | 76.4 | 11,00 | 2,80 | .08 | .74 | 2.30 | 3.86 | .36 | .05 | 2,0 | .05 | .20 | .20 | 1,000 |
| G48 | Yag | 66.7 | 11.70 | 10.70 | .15 | 1.23 | 3.00 | 4,43 | .65 | .14 | 2.0 | .07 | .50 | .20 | 1,000 |
| G50 | Yag | 67.3 | 10.60 | 1.90 | .46 | .45 | 3.60 | 5.63 | .26 | <.01 | 10.0 | .50 | 1.00 | .50 | 3,000 |
| G54 | Yr | 72.7 | 12.30 | 3.20 | .35 | 1.92 | 1,60 | 6,28 | .39 | .07 | 5.0 | .50 | 1.50 | .30 | 2,000 |
| G55 | Yr | 69.6 | 11,10 | 2.30 | .07 | 1.35 | 2,40 | 5,22 | .24 | .01 | 2.0 | .07 | 1.00 | .20 | 500 |
| G59 | Yar | 82.2 | 11.70 | 2.10 | .08 | .13 | 2.00 | 5.89 | .31 | <.01 | 3.0 | .07 | .05 | .20 | 500 |
| G60 | Yar | 76.7 | 11.90 | 2.10 | .02 | .48 | 2.60 | 6.29 | .20 | <.01 | 3.0 | .02 | .30 | .15 | 500 |
| G64A | Yr | 77.6 | 11.30 | 2.40 | .07 | .86 | 1.10 | 7.35 | .33 | .02 | 3.0 | .05 | .50 | .20 | 200 |
| G65 | Ymd | 70.0 | 13.60 | 4.70 | .81 | 1.71 | 2,70 | 4.74 | .75 | .14 | 7,0 | .70 | 1.00 | .50 | 1,500 |
| G66 | Yr | 75.7 | 11.20 | 2,00 | .40 | 1.60 | 3.50 | 2.22 | .33 | .01 | 2.0 | .50 | 1.00 | .15 | 1,000 |
| G67B | Yr | 72.6 | 12.70 | 2.90 | .13 | .39 | 3.20 | 5.26 | .48 | .05 | 5.0 | .10 | .20 | .30 | 300 |
| G68 | Yar | 71.2 | 11.20 | 1.80 | .02 | .17 | 3.50 | 4.87 | .41 | <.01 | 2.0 | .02 | .07 | .20 | 500 |
| G69 | Yar | 74.6 | 13.50 | 2.70 | .07 | .67 | 2.70 | 4.61 | .37 | .01 | 2.0 | .05 | .50 | .20 | 1,500 |
| G70 | Yr | 73.9 | 13,50 | 4.40 | .32 | 1.71 | 2.70 | 5.00 | .65 | .11 | 5.0 | .30 | 1,00 | .30 | 700 |
| G71 | Yar | 70.9 | 11.40 | 2.10 | .07 | .22 | 1.80 | 6.11 | .30 | <.01 | 2.0 | .05 | .10 | .15 | 200 |
| G72 | Yar | 71.2 | 10.90 | 2.50 | .02 | .21 | 2.60 | 4.66 | .27 | <.01 | 3.0 | <.02 | .10 | .15 | 500 |
| G73 | Ys | 57.0 | 11.50 | 4.10 | .81 | 1.42 | 2.00 | 4.88 | .61 | .12 | 5.0 | .50 | .70 | .50 | 1,000 |
| G74 | Yr | 71.2 | 12.80 | 2.50 | .27 | .79 | 1.10 | 8.42 | .46 | .05 | 2.0 | .30 | .50 | .30 | 700 |
| G76 | Yr | 67.3 | 13.50 | 5.00 | .33 | .94 | 1.40 | 7.71 | .82 | .14 | 5.0 | .20 | .50 | .50 | 1,000 |
| G77 | Yar | 76.0 | 12.30 | 2.10 | .12 | .51 | 2.40 | 5.36 | .25 | <.01 | 2.0 | .10 | .30 | .15 | 700 |
| G78 | Yar | 78.3 | 13.00 | 2.80 | .17 | .81 | 2.30 | 5.78 | .36 | .04 | 2.0 | .10 | .30 | .20 | 500 |
| G79 | Yr | 69.4 | 11.80 | 2.50 | .18 | .93 | 2.30 | 5.10 | .38 | .03 | 3.0 | .10 | .50 | .20 | 500 |
| G80 | Ys | 65.5 | 13.40 | 4.50 | .63 | 2.42 | 2.60 | 3.13 | .66 | .14 | 5.0 | .50 | 1.50 | .30 | 1,000 |
| G81 | Yar | 69,2 | 11,80 | 3.90 | .20 | .35 | .95 | 7.62 | .55 | .14 | 5.0 | .10 | .15 | .30 | 300 |
| G82 | Ymd | 70.9 | 13.20 | 4.70 | .73 | 2.03 | 2.40 | 4.40 | .66 | .15 | 5.0 | .50 | 1.00 | .50 | 700 |
| G83 | Yar | 61.2 | 13.90 | 8.70 | .12 | 3.40 | 2.40 | 4.11 | 1.40 | .42 | 2.0 | .10 | .30 | .15 | 700 |
| G84 | Ya | 78.2 | 12.00 | 2.40 | 1.64 | .61 | 2.20 | 5.00 | .19 | .01 | 10.0 | 1.00 | 2.00 | 1.00 | 1,500 |
| G85 | Ys | 68.6 | 14.50 | 6.60 | 1.28 | 2.74 | 2.80 | 3.26 | .83 | .19 | 7.0 | 1.00 | 1.50 | .50 | 1,000 |
| G86 | Ygh | 67.6 | 11.40 | 1.90 | .10 | .19 | 2.60 | 4.79 | .41 | <.01 | 2.0 | .07 | .05 | .20 | 300 |
| H2 | Yar | 71.0 | 11.70 | 4.20 | .27 | .15 | .68 | 7.56 | .23 | <.01 | 5.0 | .20 | .05 | .10 | 1,500 |
| H4 | Yar | 26.8 | 11.50 | 2.50 | .08 | .38 | 3.20 | 8.44 | .36 | .01 | 2.0 | .07 | .15 | .20 | 300 |
| H10 | Yar | 79.6 | 8.83 | 1.90 | .05 | .08 | 3.00 | 7.67 | .21 | <.01 | 1.5 | .03 | <.05 | .10 | 300 |
| H14 | Ys | 69.7 | 12.50 | 2.10 | .17 | .25 | 2.20 | 4.76 | .46 | .02 | 3.0 | .15 | .10 | .20 | 300 |
| H18 | Ys | 49.4 | 11.10 | 4.70 | 1.33 | 2.56 | 2.40 | 3.50 | .76 | .20 | 7.0 | 1.00 | 2.00 | .50 | 1,500 |
| H22 | Ys | 75.9 | 13.70 | 4.27 | .48 | .88 | 1.20 | 5.18 | .49 | .12 | 5.0 | .20 | .50 | .30 | 500 |
| H24 | Ys | 63.8 | 13.90 | 9.59 | 1.73 | 1.68 | 1.40 | 1.78 | .95 | .49 | 7.0 | 1.00 | .70 | .30 | 1,500 |
| H25 | Ys | 57.4 | 9.10 | 3.65 | .43 | 1.60 | 3.00 | 4.09 | .51 | .11 | 3.0 | .30 | 1.00 | .30 | 300 |
| H27 | Yar | 71.0 | 9.10 | 2.24 | .07 | .30 | 2.60 | 5.40 | .24 | <.01 | 1.5 | .05 | .10 | .15 | 300 |
| H28 | Ys | 74.5 | 12.60 | 2.81 | .43 | 1.21 | 2.70 | 3.96 | .47 | .11 | 2.0 | .20 | .70 | .20 | 1,000 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO | S-NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G35 | Ys | N | N | N | 10 | 1,500 | 2.0 | N | N | N | <10 | 10 | 50 | N | N |
| G38 | Ys | .5 | N | N | 10 | 500 | 2.0 | N | N | 7 | 10 | 10 | 70 | N | 20 |
| G39 | Ya | .7 | N | N | 15 | 1,000 | 3.0 | N | N | 20 | 10 | 30 | 100 | N | <20 |
| G40 | Yr | N | N | N | 10 | 1,500 | 2.0 | N | N | 5 | 10 | 10 | 100 | N | <20 |
| G41 | Ya | N | N | N | 20 | 1,000 | 1.0 | N | N | 70 | N | 20 | 20 | N | N |
| G42 | Ys | N | N | N | 10 | 1,500 | 3.0 | N | N | N | <10 | 5 | 100 | 7 | <20 |
| G46 | Yag | 1.0 | N | N | 50 | 700 | 1.5 | N | N | N | <10 | 5 | 100 | 10 | 20 |
| G48 | Yag | .5 | N | N | 50 | 700 | 2.0 | N | N | N | <10 | <5 | 70 | 10 | <20 |
| G50 | Yag | .5 | N | N | 15 | 2,000 | 2.0 | N | N | 10 | 10 | 5 | 100 | 5 | <20 |
| G54 | Yr | N | N | N | 20 | 1,500 | 1.5 | N | N | 5 | 10 | 7 | 150 | N | <20 |
| G55 | Yr | N | N | N | 20 | 700 | 10.0 | N | N | N | 10 | <5 | 300 | N | 20 |
| G59 | Yar | 50.0 | N | N | 20 | 700 | 2.0 | N | N | N | <10 | 20 | 150 | N | 20 |
| G60 | Yar | 3.0 | N | N | 10 | 700 | 3.0 | N | N | N | <10 | 5 | 100 | N | <20 |
| G64A | Yr | .5 | N | N | 15 | 1,000 | 2.0 | N | N | N | <10 | 20 | 100 | N | <20 |
| G65 | Ymd | .5 | N | N | 30 | 1,500 | 2.0 | N | N | 15 | 30 | 20 | 100 | 7 | <20 |
| G66 | Yr | 7.0 | N | N | 10 | 700 | 2.0 | N | N | 5 | 20 | 5 | 50 | N | N |
| G67B | Yr | N | N | N | 20 | 1,500 | 3.0 | N | N | N | 10 | 10 | 150 | N | <20 |
| G68 | Yar | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| G69 | Yar | N | N | N | 15 | 700 | 3.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| G70 | Yr | N | N | N | 20 | 1,500 | 2.0 | N | N | 5 | 10 | 5 | 100 | 5 | <20 |
| G71 | Yar | N | N | N | 15 | 700 | 5.0 | N | N | N | <10 | N | 70 | N | <20 |
| G72 | Yar | N | N | N | 10 | 300 | 1.5 | N | N | N | <10 | N | 100 | N | <20 |
| G73 | Ys | 1.0 | N | N | 15 | 1,000 | 3.0 | N | N | 10 | 20 | 10 | 100 | 20 | <20 |
| G74 | Yr | N | N | N | 10 | 1,500 | 1.5 | N | N | 10 | 15 | <5 | 50 | N | <20 |
| G76 | Yr | N | N | N | 50 | 1,500 | 5.0 | N | N | 10 | 20 | N | 100 | N | <20 |
| G77 | Yar | N | N | N | 10 | 700 | 5.0 | N | N | N | <10 | 5 | 100 | 10 | 20 |
| G78 | Yar | N | N | N | 20 | 1,000 | 5.0 | N | N | N | <10 | <5 | 100 | N | <20 |
| G79 | Yr | N | N | N | 20 | 1,000 | 5.0 | N | N | N | <10 | 5 | 100 | 7 | <20 |
| G80 | Ys | N | N | N | 20 | 1,000 | 2.0 | N | N | 15 | 20 | <5 | 100 | N | <20 |
| G81 | Yar | N | N | N | 20 | 2,000 | 2.0 | N | N | 5 | 15 | 10 | 100 | N | 20 |
| G82 | Ymd | N | N | N | 50 | 1,000 | 3.0 | N | N | 15 | 30 | 20 | 100 | 10 | <20 |
| G83 | Yar | N | N | N | 20 | 700 | 3.0 | N | N | N | <10 | 5 | 100 | 5 | 20 |
| G84 | Ya | N | N | N | 30 | 1,000 | 2.0 | N | N | 20 | 15 | 70 | 100 | N | <20 |
| G85 | Ys | N | N | N | 10 | 1,000 | 2.0 | N | N | 20 | 20 | N | 100 | N | <20 |
| G86 | Ygh | N | N | N | 15 | 1,000 | 2.0 | N | N | N | <10 | N | 100 | 5 | <20 |
| H2 | Yar | 1.0 | N | N | 20 | 700 | 1.5 | N | N | 10 | 30 | 50 | 100 | 15 | 20 |
| H4 | Yar | N | N | N | 20 | 700 | 3.0 | N | N | N | <10 | 5 | 100 | 5 | 20 |
| H10 | Yar | 2.0 | N | N | 20 | 700 | 2.0 | N | N | N | <10 | 20 | 50 | 30 | 20 |
| H14 | Ys | N | N | N | 20 | 1,000 | 1.5 | N | N | N | <10 | N | 30 | N | <20 |
| H18 | Ys | 1.0 | N | N | 10 | 1,000 | 2.0 | N | N | 15 | 10 | 20 | 70 | 10 | <20 |
| H22 | Ys | N | N | N | 20 | 1,000 | 1.5 | N | N | 5 | 10 | N | 50 | N | <20 |
| H24 | Ys | N | N | N | <10 | 500 | 2.0 | N | N | 10 | 10 | 100 | 30 | 5 | N |
| H25 | Ys | N | N | N | 15 | 700 | 1.5 | N | N | 5 | 10 | <5 | 50 | N | <20 |
| H27 | Yar | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | N | 70 | N | N |
| H28 | Ys | N | N | N | 10 | 500 | 1.5 | N | N | 5 | <10 | N | 70 | N | <20 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | S-GE | AA-CU-P | AA-PB-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G35 | Ys | 5 | 20 | N | 20 | N | 100 | <10 | N | 70 | N | 200 | N | N | <5 |
| G38 | Ys | 5 | 50 | N | 20 | N | 100 | 50 | N | 150 | N | 500 | N | N | 10 |
| G39 | Ya | 5 | 3,000 | N | 20 | N | 300 | 100 | N | 100 | 500 | 200 | N | <5 | 200 |
| G40 | Yr | 5 | 20 | N | 30 | N | 200 | 30 | N | 100 | N | 300 | N | 200 | <5 |
| G41 | Ya | 5 | 15 | N | 30 | N | 500 | 500 | N | 50 | N | 100 | N | <5 | <5 |
| G42 | Ys | <5 | 50 | N | 20 | N | 150 | <10 | N | 100 | N | 500 | N | N | 5 |
| G46 | Yag | 5 | 15 | N | 10 | N | <100 | <10 | N | 70 | N | 500 | N | N | <5 |
| G48 | Yag | <5 | 100 | N | 10 | N | <100 | 15 | N | 70 | N | 300 | N | N | 5 |
| G50 | Yag | 5 | 100 | N | 30 | N | 100 | 30 | N | 70 | 500 | 300 | N | N | <5 |
| G54 | Yr | <5 | 200 | N | 20 | 10 | 150 | 20 | N | 150 | N | 300 | N | N | 10 |
| G55 | Yr | 5 | 20 | N | 7 | 15 | <100 | <10 | N | 200 | N | 200 | N | N | <5 |
| G59 | Yar | 10 | 15 | N | 5 | N | <100 | <10 | N | 100 | N | 500 | N | <5 | <5 |
| G60 | Yar | <5 | 30 | N | 7 | <10 | <100 | <10 | N | 100 | N | 300 | N | <5 | 5 |
| G64A | Yr | <5 | 30 | N | 10 | <10 | 100 | 10 | N | 100 | N | 500 | N | 5 | 5 |
| G65 | Ymd | 15 | 50 | N | 20 | N | 150 | 70 | <50 | 100 | N | 300 | N | 5 | 20 |
| G66 | Yr | 5 | 10 | N | 10 | N | 150 | 20 | N | 50 | N | 300 | N | N | <5 |
| G67B | Yr | <5 | 20 | N | 20 | N | <100 | 20 | N | 150 | N | 300 | N | -- | -- |
| G68 | Yar | 5 | 10 | N | 7 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| G69 | Yar | <5 | 20 | N | 20 | N | 100 | 10 | N | 100 | N | 300 | N | -- | -- |
| G70 | Yr | 5 | 30 | N | 20 | N | 100 | 50 | N | 100 | N | 300 | N | -- | -- |
| G71 | Yar | 5 | 10 | N | 7 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| G72 | Yar | 5 | 50 | N | 10 | N | <100 | <10 | N | 100 | N | 300 | N | -- | -- |
| G73 | Ys | 10 | 50 | N | 20 | N | 100 | 70 | N | 100 | N | 300 | N | -- | -- |
| G74 | Yr | 10 | 30 | N | 15 | N | 100 | 30 | N | 70 | N | 300 | N | -- | -- |
| G76 | Yr | 15 | 50 | N | 20 | N | 100 | 70 | N | 150 | N | 300 | N | -- | -- |
| G77 | Yar | <5 | 70 | N | 10 | 10 | <100 | <10 | N | 100 | N | 500 | N | -- | -- |
| G78 | Yar | <5 | 50 | N | 15 | N | 100 | 10 | N | 100 | N | 500 | N | -- | -- |
| G79 | Yr | <5 | 50 | N | 20 | 10 | 100 | 10 | N | 100 | N | 300 | N | -- | -- |
| G80 | Ys | 15 | 70 | N | 20 | N | 200 | 100 | N | 150 | N | 300 | N | -- | -- |
| G81 | Yar | 7 | 70 | N | 20 | N | 100 | 50 | N | 100 | N | 300 | N | -- | -- |
| G82 | Ymd | 15 | 20 | N | 30 | N | 150 | 70 | N | 100 | N | 500 | N | -- | -- |
| G83 | Yar | <5 | 50 | N | 10 | <10 | <100 | <10 | N | 150 | N | 300 | N | -- | -- |
| G84 | Ys | 5 | 50 | N | 30 | N | 500 | 150 | N | 100 | N | 200 | N | -- | -- |
| G85 | Ys | 20 | 50 | N | 30 | N | 300 | 300 | N | 100 | N | 500 | N | -- | -- |
| G86 | Ygh | 5 | 15 | N | 10 | 10 | <100 | <10 | N | 70 | N | 300 | N | -- | -- |
| H2 | Yar | 50 | 15 | N | 7 | 15 | <100 | 10 | N | 150 | N | 500 | N | N | <5 |
| H4 | Yar | 5 | 20 | N | 15 | <10 | <100 | <10 | N | 100 | N | 500 | N | 5 | 5 |
| H10 | Yar | 5 | 70 | N | 5 | N | <100 | <10 | N | 100 | N | 500 | N | 10 | 35 |
| H14 | Ys | 5 | 20 | N | 20 | N | 200 | 10 | N | 70 | N | 300 | N | <5 | <5 |
| H18 | Ys | 5 | 50 | N | 30 | N | 300 | 70 | N | 100 | N | 200 | N | <5 | 5 |
| H22 | Ys | <5 | 15 | N | 10 | N | 300 | 50 | N | 30 | N | 200 | N | -- | -- |
| H24 | Ys | <5 | 10 | N | 20 | N | 100 | 50 | N | 30 | 500 | 200 | N | -- | -- |
| H25 | Ys | <5 | 10 | N | 10 | N | 150 | 20 | N | 50 | N | 300 | N | -- | -- |
| H27 | Yar | <5 | 15 | N | 5 | N | 100 | <10 | N | 30 | N | 150 | N | -- | -- |
| H28 | Ys | <5 | 20 | N | 15 | N | 100 | 20 | N | 50 | N | 200 | N | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | AA-ZN-P | AA-AG-P | AA-CD-P | AA-BI-P | AA-SB-P | AA-SN-P | AA-LI | CM-AS | CM-W-P | INST-HG | SI-F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G35 | Ys | 20 | .65 | <.05 | <.5 | N | N | 4 | <10 | 1 | .30 | 1,260 |
| G38 | Ys | 15 | 3.00 | <.05 | <.5 | N | 2 | 1 | <10 | 1 | .16 | 960 |
| G39 | Ya | 200 | .20 | .45 | <.5 | N | N | 19 | 10 | <1 | .10 | 1,600 |
| G40 | Yr | 80 | 1.40 | <.05 | <.5 | N | N | 11 | 10 | <1 | .40 | 760 |
| G41 | Ya | 80 | .20 | .05 | <.5 | N | N | 59 | 10 | N | .30 | 1,340 |
| G42 | Ys | 20 | .70 | <.05 | <.5 | N | <1 | 3 | 10 | 1 | .18 | 1,200 |
| G46 | Yag | 15 | .45 | <.05 | <.5 | N | 1 | 3 | <10 | 2 | .24 | 940 |
| G48 | Yag | 20 | .35 | <.05 | <.5 | N | N | 18 | <10 | 7 | .14 | 2,500 |
| G50 | Yag | 110 | .20 | <.05 | <.5 | N | N | 12 | 10 | 2 | .16 | 640 |
| G54 | Yr | 80 | .20 | <.05 | <.5 | N | 1 | 16 | N | <1 | .12 | 800 |
| G55 | Yr | 15 | 4.00 | <.05 | <.5 | N | 1 | 7 | <10 | 1 | .20 | 880 |
| G59 | Yar | 10 | 1.70 | <.05 | <.5 | N | N | N | 10 | <1 | .18 | 620 |
| G60 | Yar | 25 | 1.00 | <.05 | <.5 | N | N | 1 | 10 | 1 | .12 | 1,900 |
| G64A | Yr | 20 | .50 | <.05 | <.5 | N | N | 1 | N | <1 | .14 | 480 |
| G65 | Ymd | 80 | 1.30 | .10 | <.5 | N | <1 | 28 | 10 | 1 | .20 | 1,300 |
| G66 | Yr | 40 | .25 | <.05 | <.5 | N | N | 9 | N | N | .10 | 640 |
| G67B | Yr | -- | -- | -- | -- | -- | -- | 12 | -- | -- | -- | -- |
| G68 | Yar | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | -- |
| G69 | Yar | -- | -- | -- | -- | -- | -- | 8 | -- | -- | -- | -- |
| G70 | Yr | -- | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- |
| G71 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| G72 | Yar | -- | -- | -- | -- | -- | -- | N | -- | -- | -- | -- |
| G73 | Ys | -- | -- | -- | -- | -- | -- | 21 | -- | -- | -- | -- |
| G74 | Yr | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| G76 | Yr | -- | -- | -- | -- | -- | -- | 14 | -- | -- | -- | -- |
| G77 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| G78 | Yar | -- | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- |
| G79 | Yr | -- | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- |
| G80 | Ys | -- | -- | -- | -- | -- | -- | 23 | -- | -- | -- | -- |
| G81 | Yar | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| G82 | Ymd | -- | -- | -- | -- | -- | -- | 21 | -- | -- | -- | -- |
| G83 | Yar | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| G84 | Ya | -- | -- | -- | -- | -- | -- | 41 | -- | -- | -- | -- |
| G85 | Ys | -- | -- | -- | -- | -- | -- | 26 | -- | -- | -- | -- |
| G86 | Ygh | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H2 | Yar | 50 | .70 | <.05 | <.5 | N | N | 9 | N | <1 | .18 | 840 |
| H4 | Yar | 25 | .20 | <.05 | <.5 | N | 1 | 3 | N | <1 | .16 | 1,184 |
| H10 | Yar | 50 | .60 | .05 | <.5 | N | N | 4 | N | 1 | .30 | 540 |
| H14 | Ys | 10 | .30 | <.05 | <.5 | N | N | 7 | N | 1 | .12 | 640 |
| H18 | Ys | 80 | .25 | <.05 | <.5 | N | N | 11 | 10 | N | .22 | 1,480 |
| H22 | Ys | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |
| H24 | Ys | -- | -- | -- | -- | -- | -- | 19 | -- | -- | -- | -- |
| H25 | Ys | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |
| H27 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| H28 | Ys | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | SIO2% | AL203% | FE203% | MGO% | CAO% | NA20% | K20% | TIO2% | P205% | S-FE% | S-MG% | S-CA% | S-TI% | S-MN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H30 | Ys | 75.3 | 11.50 | 2.06 | .10 | .24 | 3.10 | 1.79 | .27 | <.01 | 1.5 | .05 | .10 | .10 | 200 |
| H33 | Ys | 73.4 | 12.20 | 1.98 | .33 | .42 | .95 | 3.64 | .43 | <.01 | 1.5 | .20 | .20 | .10 | 1,000 |
| H34 | Ys | 69.1 | 12.30 | 3.42 | .56 | .79 | 2.80 | 4.19 | .38 | .06 | 3.0 | .50 | .30 | .20 | 700 |
| H37 | Ys | 74.0 | 13.40 | 2.77 | .23 | .55 | 3.10 | 5.60 | .33 | .02 | 3.0 | .20 | .30 | .15 | 1,500 |
| H40 | Ys | 70.5 | 12.80 | 3.01 | .48 | 1.29 | 2.60 | 4.14 | .34 | .04 | 3.0 | .30 | .70 | .20 | 1,000 |
| H41 | Ys | 70.2 | 13.00 | 3.32 | .85 | 2.30 | 3.90 | 3.79 | .36 | .07 | 2.0 | .70 | 1.50 | .20 | 1,000 |
| H43 | Ys | 71.1 | 13.60 | 3.20 | .38 | .25 | 3.10 | 3.99 | .39 | .02 | 2.0 | .20 | .07 | .20 | 500 |
| H44 | Ys | 73.0 | 12.60 | 2.50 | .18 | .80 | 5.30 | 4.12 | .25 | .01 | 1.5 | .10 | .30 | .15 | 1,000 |
| H45 | Yar | 82.2 | 11.70 | 2.17 | .12 | .46 | .81 | 6.25 | .22 | .02 | 1.5 | .10 | .20 | .10 | 1,000 |
| H46 | Ys | 62.2 | 12.00 | 3.25 | .32 | .71 | 2.80 | 3.00 | .41 | .01 | 2.0 | .20 | .30 | .15 | 1,000 |
| H49 | Yar | 77.0 | 12.60 | 2.14 | .07 | .44 | .14 | 3.92 | .27 | .02 | 1.0 | .05 | .20 | .10 | 1,000 |
| H50 | Ys | 77.8 | 13.30 | 2.24 | .13 | .70 | 3.10 | 4.33 | .52 | .01 | 1.0 | .07 | .20 | .15 | 500 |
| H51 | Ys | 70.0 | 13.00 | 3.12 | .46 | 1.13 | .27 | 2.16 | .52 | .06 | 2.0 | .30 | .70 | .20 | 1,500 |
| H52 | Yr | 69.4 | 13.40 | 4.36 | .91 | 2.28 | 3.80 | 2.99 | .60 | .15 | 2.0 | .50 | 1.00 | .20 | 1,500 |
| H53 | Ys | 78.0 | 14.90 | 3.29 | .50 | 1.27 | 3.40 | 3.16 | .59 | .08 | 3.0 | .30 | .70 | .30 | 2,000 |
| H54 | Ys | 75.8 | 12.50 | 2.24 | .17 | .40 | 4.90 | 3.94 | .21 | <.01 | 1.0 | .07 | .15 | .10 | 300 |
| H55 | Yar | 76.2 | 11.20 | 2.52 | .07 | .30 | 4.10 | 5.45 | .19 | <.01 | 1.5 | .02 | .15 | .10 | 300 |
| H56 | Yar | 74.5 | 12.30 | 1.36 | .15 | .30 | 2.80 | 5.71 | .18 | <.01 | .7 | .07 | .15 | .10 | 200 |
| H58 | Yar | 78.1 | 11.50 | 2.26 | .12 | .33 | 3.40 | 6.12 | .23 | <.01 | 1.0 | .05 | .15 | .10 | 1,500 |
| H59 | Ys | 69.7 | 13.90 | 4.82 | 1.08 | 2.24 | 4.70 | 3.97 | .62 | .25 | 5.0 | .70 | 1.00 | .30 | 1,500 |
| H60 | Ys | 74.1 | 14.10 | 3.66 | .46 | .97 | 3.90 | 3.80 | .44 | .07 | 3.0 | .50 | 1.50 | .20 | 1,000 |
| H61 | Ys | 78.4 | 13.30 | 2.29 | .12 | .44 | 3.50 | 3.34 | .22 | <.01 | 1.5 | .07 | .50 | .10 | 500 |
| H62 | Yar | 77.7 | 11.20 | 2.64 | .05 | .31 | 3.40 | 6.93 | .21 | <.01 | 2.0 | .03 | .20 | .10 | 500 |
| H64 | Yar | 75.8 | 13.10 | 1.95 | .08 | .42 | 3.80 | 8.00 | .33 | .02 | 1.5 | .05 | .30 | .20 | 500 |
| H65 | Yar | 62.0 | 11.40 | 3.68 | .36 | .86 | 3.00 | 4.87 | .42 | .03 | 3.0 | .20 | .50 | .20 | 2,000 |
| H67 | Yar | 67.9 | 13.40 | 4.83 | 1.08 | 2.16 | 4.20 | 3.39 | .86 | .24 | 5.0 | .70 | 1.00 | .50 | 2,000 |
| H68 | Ys | 72.4 | 12.30 | 1.71 | .07 | .22 | 3.40 | 4.47 | .30 | <.01 | 1.0 | .02 | .10 | .07 | 300 |
| H69 | Yr | 62.4 | 13.00 | 5.03 | 1.26 | 2.33 | 1.90 | 3.16 | .75 | .25 | 5.0 | 1.00 | 1.00 | .50 | 2,000 |
| H70 | Ys | 67.6 | 12.60 | 4.18 | .53 | .82 | 4.60 | 3.46 | .41 | .04 | 2.0 | .50 | .30 | .20 | 1,500 |
| H71 | Yr | 72.7 | 13.40 | 4.22 | .86 | .80 | 4.10 | 3.98 | .59 | .11 | 3.0 | .70 | .50 | .30 | 2,000 |
| H72 | Ys | 74.8 | 13.70 | 2.28 | .12 | .31 | 3.80 | 5.52 | .41 | .01 | 2.0 | .10 | .15 | .20 | 700 |
| H73 | Yr | 70.0 | 13.90 | 4.82 | 1.10 | 2.59 | 3.60 | 3.41 | .78 | .27 | 5.0 | 1.00 | 1.50 | .50 | 2,000 |
| H76 | Yar | 76.0 | 12.30 | 1.87 | .08 | .30 | 3.40 | 4.55 | .27 | <.01 | 1.0 | .05 | .15 | .15 | 700 |
| H78 | Ys | 71.5 | 12.80 | 3.02 | .27 | 1.23 | 3.40 | 4.57 | .43 | .05 | 1.5 | .20 | .20 | .20 | 1,000 |
| H79 | Yar | 78.5 | 11.20 | 2.08 | .03 | 1.17 | 2.70 | 4.65 | .19 | .01 | 1.5 | .02 | .20 | .07 | 500 |
| H80 | Ys | 72.7 | 13.00 | 2.85 | .18 | .66 | 4.10 | 4.06 | .40 | .03 | 2.0 | .15 | .20 | .20 | 2,000 |
| H81A | Ygh | 79.8 | 12.80 | 2.69 | .08 | .80 | 2.60 | 5.78 | .26 | <.01 | 2.0 | .07 | .15 | .15 | 700 |
| H83 | Yar | 75.5 | 12.50 | 2.96 | .13 | .57 | 1.50 | 6.65 | .34 | .02 | 2.0 | .10 | .15 | .20 | 500 |
| H84 | Yr | 72.3 | 13.00 | 3.79 | .45 | 1.50 | 2.40 | 5.40 | .48 | .09 | 3.0 | .30 | .50 | .30 | 700 |
| H85 | Yar | 68.3 | 10.90 | 2.08 | .13 | .28 | 5.10 | 2.65 | .18 | <.01 | 1.5 | .10 | .10 | .10 | 300 |
| H86 | Yr | 72.6 | 13.30 | 4.30 | .96 | 1.83 | 3.90 | 3.67 | .56 | .12 | 3.0 | .50 | 1.00 | .20 | 1,500 |
| H87 | Yr | 76.7 | 12.60 | 2.25 | .18 | .28 | 2.40 | 6.16 | .26 | <.01 | 1.0 | .15 | .10 | .20 | 700 |
| H88 | Ys | 71.8 | 12.50 | 3.11 | .23 | .47 | 5.00 | 2.46 | .34 | <.01 | 2.0 | .15 | .15 | .20 | 700 |
| H89 | Yr | 75.6 | 11.80 | 2.44 | .08 | 1.24 | 2.40 | 4.92 | .22 | <.01 | 2.0 | .05 | .70 | .15 | 1,000 |
| H90 | Yar | 80.9 | 12.30 | 2.53 | .05 | .33 | 3.10 | 5.30 | .20 | <.01 | 2.0 | .03 | .15 | .10 | 700 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri—continued

| sample | | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO | S-NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H30 | Ys | N | N | N | 10 | 300 | 1.0 | N | N | N | <10 | N | 70 | N | <20 |
| H33 | Ys | N | N | N | 15 | 700 | 1.5 | N | N | N | <10 | N | 30 | N | N |
| H34 | Ys | N | N | N | 10 | 700 | 1.0 | N | N | N | <10 | N | 50 | N | <20 |
| H37 | Ys | N | N | N | <10 | 700 | 1.0 | N | N | 5 | 200 | 30 | 70 | 10 | N |
| H40 | Ys | N | N | N | 20 | 700 | 1.5 | N | N | 5 | 10 | 5 | 70 | N | N |
| H41 | Ys | N | N | N | 30 | 700 | 2.0 | N | N | 10 | 10 | 5 | 50 | N | <20 |
| H43 | Ys | N | N | N | 20 | 700 | 2.0 | N | N | 5 | <10 | <5 | 70 | N | <20 |
| H44 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | N | 15 | 5 | 50 | 15 | <20 |
| H45 | Yar | N | N | N | 10 | 300 | 1.0 | N | N | N | <10 | 5 | 100 | N | <20 |
| H46 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | N | 50 | N | <20 |
| H49 | Yar | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | N | 50 | <5 | <20 |
| H50 | Ys | N | N | N | <10 | 700 | 2.0 | N | N | N | <10 | N | 50 | <5 | <20 |
| H51 | Ys | N | N | N | <10 | 500 | 2.0 | N | N | N | <10 | <5 | 50 | 7 | <20 |
| H52 | Yr | <.5 | N | N | 15 | 700 | 2.0 | N | N | 7 | <10 | <5 | 50 | N | <20 |
| H53 | Ys | N | N | N | 15 | 700 | 2.0 | N | N | N | <10 | N | 70 | N | <20 |
| H54 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | N | <10 | N | 20 | N | <20 |
| H55 | Yar | N | N | N | 10 | 500 | 3.0 | N | N | N | <10 | <5 | 50 | N | 20 |
| H56 | Yar | N | N | N | 10 | 700 | 1.5 | N | N | N | <10 | N | 70 | N | 20 |
| H58 | Yar | N | N | N | 20 | 200 | 2.0 | N | N | N | <10 | <5 | 70 | N | <20 |
| H59 | Ys | N | N | N | 10 | 1,000 | 2.0 | N | N | 10 | <10 | 10 | 50 | N | <20 |
| H60 | Ys | N | N | N | 15 | 1,000 | 2.0 | N | N | 5 | <10 | N | 50 | N | <20 |
| H61 | Ys | N | N | N | 10 | 1,500 | 2.0 | N | N | N | <10 | <5 | 50 | N | <20 |
| H62 | Yar | N | N | N | 10 | 700 | 1.0 | N | N | N | <10 | N | 70 | N | 20 |
| H64 | Yar | N | N | N | 10 | 1,500 | 1.0 | N | N | N | <10 | 70 | 70 | 50 | <20 |
| H65 | Yar | N | N | N | 10 | 1,500 | 1.5 | N | N | 5 | <10 | 7 | 100 | N | <20 |
| H67 | Yar | N | N | N | 10 | 1,000 | 2.0 | N | N | 7 | <10 | N | 50 | <5 | <20 |
| H68 | Ys | N | N | N | 10 | 1,000 | 2.0 | N | N | N | 10 | <5 | 30 | N | N |
| H69 | Yr | N | N | N | 15 | 1,000 | 2.0 | N | N | 10 | 10 | 5 | 50 | 5 | <20 |
| H70 | Ys | N | N | N | 10 | 700 | 2.0 | N | N | 5 | 15 | 5 | 50 | N | N |
| H71 | Yr | N | N | N | 10 | 1,000 | 2.0 | N | N | 7 | <10 | <5 | 50 | N | <20 |
| H72 | Ys | 10.0 | N | N | 10 | 1,500 | 1.0 | N | N | N | <10 | 15 | 70 | N | N |
| H73 | Yr | N | N | N | 15 | 1,000 | 2.0 | N | N | 10 | <10 | 5 | 70 | 5 | <20 |
| H76 | Yar | N | N | N | 10 | 1,000 | 3.0 | N | N | N | <10 | <5 | 50 | N | <20 |
| H78 | Ys | N | N | N | 10 | 1,000 | 3.0 | N | N | 5 | <10 | <5 | 70 | N | <20 |
| H79 | Yar | N | N | N | 10 | 500 | 1.5 | N | N | N | <10 | N | 20 | N | <20 |
| H80 | Ys | N | N | N | 10 | 1,500 | 3.0 | N | N | N | <10 | N | 70 | N | <20 |
| H81A | Ygh | N | N | N | 20 | 1,000 | 1.5 | N | N | N | <10 | 5 | 100 | 10 | 20 |
| H83 | Yar | N | N | N | 30 | 1,500 | 3.0 | N | N | N | <10 | 5 | 100 | N | 20 |
| H84 | Yr | N | N | N | 15 | 1,000 | 1.5 | N | N | 7 | 10 | N | 70 | 5 | <20 |
| H85 | Yar | N | N | N | 10 | 1,000 | 1.0 | N | N | 5 | <10 | N | 20 | N | <20 |
| H86 | Yr | N | N | N | <10 | 1,000 | 1.5 | N | N | 7 | <10 | N | 50 | N | <20 |
| H87 | Yr | N | N | N | 10 | 1,000 | 1.0 | N | N | N | <10 | N | 50 | N | <20 |
| H88 | Ys | N | N | N | 10 | 700 | 1.5 | N | N | N | <10 | N | 50 | N | N |
| H89 | Yr | N | N | N | 50 | 300 | 1.5 | N | N | N | <10 | N | 70 | N | <20 |
| H90 | Yar | N | N | N | 10 | 300 | 1.5 | N | N | N | <10 | <5 | 70 | N | <20 |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | S-GE | AA-CU-P | AA-PB-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H30 | Ys | <5 | <10 | N | 5 | <10 | <100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H33 | Ys | <5 | 10 | N | 5 | N | 100 | 30 | N | 20 | N | 150 | N | -- | -- |
| H34 | Ys | <5 | 10 | N | 10 | N | 100 | <10 | N | 50 | N | 150 | N | -- | -- |
| H37 | Ys | 20 | 10 | N | 10 | <10 | <100 | <10 | N | 50 | N | 150 | N | -- | -- |
| H40 | Ys | 5 | 20 | N | 15 | N | 150 | 15 | N | 50 | N | 200 | N | -- | -- |
| H41 | Ys | 10 | 20 | N | 15 | N | 150 | 50 | N | 50 | N | 200 | N | -- | -- |
| H43 | Ys | <5 | 15 | N | 15 | N | 100 | 10 | N | 70 | N | 300 | N | -- | -- |
| H44 | Ys | 5 | 20 | N | 10 | N | 100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H45 | Yar | <5 | 20 | N | 7 | 10 | <100 | <10 | N | 100 | N | 150 | N | -- | -- |
| H46 | Ys | <5 | <10 | N | 15 | N | 100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H49 | Yar | <5 | 15 | N | 10 | <10 | <100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H50 | Ys | <5 | 15 | N | 10 | N | 100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H51 | Ys | <5 | 30 | N | 15 | N | 150 | <10 | N | 50 | N | 200 | N | -- | -- |
| H52 | Yr | <5 | 20 | N | 15 | N | 200 | 20 | N | 50 | 200 | 150 | N | -- | -- |
| H53 | Ys | <5 | 150 | N | 15 | N | 200 | <10 | N | 70 | 200 | 200 | N | -- | -- |
| H54 | Ys | <5 | 10 | N | 5 | N | 150 | 10 | N | 20 | N | 100 | N | -- | -- |
| H55 | Yar | <5 | 20 | N | 5 | <10 | <100 | <10 | N | 70 | N | 300 | N | -- | -- |
| H56 | Yar | <5 | 10 | N | 5 | N | 100 | 10 | N | 50 | N | 200 | N | -- | -- |
| H58 | Yar | <5 | 50 | N | 5 | <10 | <100 | 10 | N | 50 | N | 300 | N | -- | -- |
| H59 | Ys | <5 | 50 | N | 20 | N | 300 | 70 | N | 50 | 200 | 200 | N | -- | -- |
| H60 | Ys | <5 | 10 | N | 10 | N | 150 | 15 | N | 50 | N | 300 | N | -- | -- |
| H61 | Ys | <5 | 100 | N | 5 | N | 100 | 10 | N | 30 | N | 150 | N | -- | -- |
| H62 | Yar | <5 | 10 | N | 7 | <10 | <100 | <10 | N | 70 | N | 500 | N | -- | -- |
| H64 | Yar | <5 | 30 | N | 10 | <10 | <100 | 10 | N | 50 | N | 300 | N | -- | -- |
| H65 | Yar | <5 | 50 | N | 20 | N | <100 | 20 | N | 70 | N | 300 | N | -- | -- |
| H67 | Yar | <5 | 30 | N | 20 | N | 300 | 50 | N | 70 | N | 300 | N | -- | -- |
| H68 | Ys | 5 | 15 | N | <5 | N | 100 | 10 | N | 20 | N | 100 | N | -- | -- |
| H69 | Yr | <5 | 20 | N | 20 | N | 300 | 50 | N | 70 | <200 | 200 | N | -- | -- |
| H70 | Ys | 5 | 10 | N | 15 | N | 100 | 30 | N | 50 | N | 200 | N | -- | -- |
| H71 | Yr | 5 | 30 | N | 20 | N | 150 | 30 | N | 50 | <200 | 200 | N | -- | -- |
| H72 | Ys | <5 | 70 | N | 15 | N | 150 | 10 | N | 70 | <200 | 200 | N | -- | -- |
| H73 | Yr | <5 | 50 | N | 20 | N | 300 | 30 | N | 70 | N | 200 | N | -- | -- |
| H76 | Yar | <5 | 20 | N | 7 | N | 100 | 10 | N | 70 | N | 200 | N | -- | -- |
| H78 | Ys | <5 | 50 | N | 15 | N | 150 | 10 | N | 70 | N | 200 | N | -- | -- |
| H79 | Yar | <5 | 20 | N | <5 | N | 100 | <10 | N | 70 | N | 500 | N | -- | -- |
| H80 | Ys | <5 | 10 | N | 15 | N | 200 | <10 | N | 50 | 200 | 200 | N | -- | -- |
| H81A | Ygh | <5 | 50 | N | <5 | 20 | <100 | <10 | N | 150 | N | 200 | N | -- | -- |
| H83 | Yar | <5 | 30 | N | 20 | N | 100 | 30 | N | 100 | N | 500 | N | -- | -- |
| H84 | Yr | 5 | 30 | N | 15 | N | 100 | 30 | N | 100 | N | 500 | N | -- | -- |
| H85 | Yar | <5 | 10 | N | 5 | N | <100 | <10 | N | 50 | N | 200 | N | -- | -- |
| H86 | Yr | <5 | 20 | N | 15 | N | 200 | 20 | N | 50 | N | 200 | N | -- | -- |
| H87 | Yr | <5 | 20 | N | 7 | N | <100 | 10 | N | 50 | N | 150 | N | -- | -- |
| H88 | Ys | <5 | 15 | N | 10 | N | 100 | 10 | N | 50 | N | 200 | N | -- | -- |
| H89 | Yr | <5 | 20 | N | 5 | <10 | <100 | <10 | N | 70 | N | 300 | N | -- | -- |
| H90 | Yar | <5 | 20 | N | 5 | N | <100 | <10 | N | 70 | N | 500 | N | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | | AA-ZN-P | AA-AG-P | AA-CD-P | AA-BI-P | AA-SB-P | AA-SN-P | AA-LI | CM-AS | CM-W-P | INST-HG | SI-F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H30 | Ys | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| H33 | Ys | -- | -- | -- | -- | -- | -- | 18 | -- | -- | -- | -- |
| H34 | Ys | -- | -- | -- | -- | -- | -- | 14 | -- | -- | -- | -- |
| H37 | Ys | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |
| H40 | Ys | -- | -- | -- | -- | -- | -- | 27 | -- | -- | -- | -- |
| H41 | Ys | -- | -- | -- | -- | -- | -- | 28 | -- | -- | -- | -- |
| H43 | Ys | -- | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- |
| H44 | Ys | -- | -- | -- | -- | -- | -- | 9 | -- | -- | -- | -- |
| H45 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H46 | Ys | -- | -- | -- | -- | -- | -- | 8 | -- | -- | -- | -- |
| H49 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H50 | Ys | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| H51 | Ys | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- |
| H52 | Yr | -- | -- | -- | -- | -- | -- | 28 | -- | -- | -- | -- |
| H53 | Ys | -- | -- | -- | -- | -- | -- | 18 | -- | -- | -- | -- |
| H54 | Ys | -- | -- | -- | -- | -- | -- | 6 | -- | -- | -- | -- |
| H55 | Yar | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| H56 | Yar | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| H58 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H59 | Ys | -- | -- | -- | -- | -- | -- | 14 | -- | -- | -- | -- |
| H60 | Ys | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| H61 | Ys | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H62 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H64 | Yar | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| H65 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| H67 | Yar | -- | -- | -- | -- | -- | -- | 10 | -- | -- | -- | -- |
| H68 | Ys | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H69 | Yr | -- | -- | -- | -- | -- | -- | 32 | -- | -- | -- | -- |
| H70 | Ys | -- | -- | -- | -- | -- | -- | 8 | -- | -- | -- | -- |
| H71 | Yr | -- | -- | -- | -- | -- | -- | 17 | -- | -- | -- | -- |
| H72 | Ys | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| H73 | Yr | -- | -- | -- | -- | -- | -- | 18 | -- | -- | -- | -- |
| H76 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |
| H78 | Ys | -- | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- |
| H79 | Yar | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- |
| H80 | Ys | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| H81A | Ygh | -- | -- | -- | -- | -- | -- | 6 | -- | -- | -- | -- |
| H83 | Yar | -- | -- | -- | -- | -- | -- | 6 | -- | -- | -- | -- |
| H84 | Yr | -- | -- | -- | -- | -- | -- | 14 | -- | -- | -- | -- |
| H85 | Yar | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| H86 | Yr | -- | -- | -- | -- | -- | -- | 13 | -- | -- | -- | -- |
| H87 | Yr | -- | -- | -- | -- | -- | -- | 5 | -- | -- | -- | -- |
| H88 | Ys | -- | -- | -- | -- | -- | -- | 7 | -- | -- | -- | -- |
| H89 | Yr | -- | -- | -- | -- | -- | -- | 4 | -- | -- | -- | -- |
| H90 | Yar | -- | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |

Table 2.--Spectrographic and chemical analyses of Precambrian rock samples, Rolla 1° X 2° quadrangle, Missouri--continued

| sample | SI02% | AL203% | FE203% | MGO% | CAO% | NA20% | K20% | TI02% | P205% | S-FE% | S-MG% | S-CA% | S-TI% | S-MN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H91 Ys | 70.2 | 13.40 | 3.47 | .46 | 1.05 | 4.10 | 3.70 | .44 | .07 | 2.0 | .50 | .50 | .20 | 1,000 |
| H92 Ys | 70.7 | 13.30 | 3.95 | .80 | 2.28 | 5.10 | 2.32 | .44 | .09 | 3.0 | .70 | 1.00 | .30 | 1,500 |
| R025 Ys | 65.7 | 12.00 | 3.39 | <2.00 | .43 | -- | 4.81 | .39 | .01 | 1.5 | .05 | .10 | .10 | 150 |
| R029 Yhm | 73.0 | 12.60 | 3.39 | <2.00 | .84 | -- | 5.09 | .39 | .01 | 2.0 | .15 | .70 | .20 | 500 |
| R030 Yhm | 71.0 | 13.00 | 3.48 | <2.00 | .43 | -- | 5.00 | .50 | .01 | 3.0 | .15 | .70 | .20 | 500 |

| sample | S-AG | S-AS | S-AU | S-B | S-BA | S-BE | S-BI | S-CD | S-CO | S-CR | S-CU | S-LA | S-MO | S-NB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H91 Ys | N | N | N | 15 | 1,000 | 2.0 | N | N | 7 | <10 | 15 | 70 | N | <20 |
| H92 Ys | N | N | N | 10 | 700 | 1.0 | N | N | 7 | 10 | 10 | 50 | N | <20 |
| R025 Ys | N | N | N | N | 500 | 10.0 | N | N | N | N | N | N | N | N |
| R029 Yhm | N | N | N | <10 | 1,500 | 7.0 | N | N | N | N | <5 | 70 | N | N |
| R030 Yhm | N | N | N | N | 2,000 | 7.0 | <10 | N | N | N | 7 | 70 | <5 | N |

| sample | S-NI | S-PB | S-SB | S-SC | S-SN | S-SR | S-V | S-W | S-Y | S-ZN | S-ZR | S-GE | AA-CU-P | AA-PB-P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H91 Ys | <5 | 20 | N | 10 | N | 200 | 20 | N | 70 | N | 300 | N | -- | -- |
| H92 Ys | 5 | 20 | N | 15 | N | 150 | 30 | N | 70 | N | 300 | N | -- | -- |
| R025 Ys | 15 | <10 | N | 5 | N | N | <10 | N | 50 | N | 150 | -- | -- | -- |
| R029 Yhm | N | 20 | N | 7 | <10 | N | N | N | 70 | N | 500 | -- | -- | -- |
| R030 Yhm | N | 30 | N | 10 | <10 | 100 | 10 | N | 100 | N | 500 | -- | -- | -- |

| sample | AA-ZN-P | AA-AG-P | AA-CD-P | AA-BI-P | AA-SB-P | AA-SN-P | AA-LI | CM-AS | CM-U-P | INST-HG | SI-F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| H91 Ys | -- | -- | -- | -- | -- | -- | 14 | -- | -- | -- | -- |
| H92 Ys | -- | -- | -- | -- | -- | -- | 15 | -- | -- | -- | -- |
| R025 Ys | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| R029 Yhm | 40 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| R030 Yhm | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |