

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

Analyses and descriptions of geochemical samples, Barbours Creek  
and Shawvers Run Wilderness Study Areas, Craig County, Virginia

by

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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## CONTENTS

	Page
Studies Related to Wilderness -----	1
Abstract -----	1
Introduction -----	2
Analytical techniques -----	2
Rock descriptions -----	4
Explanation of tables -----	8
References cited -----	9

## Illustrations

Index Map showing location of Barbours Creek and Shawvers Run Wilderness Study Areas -----	3
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## TABLES

Table 1.-- Analyses of rock samples from Barbours Creek and Shawvers Run Wilderness Study Areas, Craig County, Virginia -----	10
Table 2.-- Analyses of stream sediment samples from Barbours Creek and Shawvers Run Wilderness Study Areas, Craig County, Virginia -----	14

## STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey (USGS) and the U.S. Bureau of Mines to survey certain areas on Federal lands in order to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the analytical results of a geochemical survey of the Barbours Creek and Shawvers Run Roadless Areas (08-183) in the Jefferson National Forest, Craig County, Va. The areas were classified as nonwilderness during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January, 1979, and designated wilderness study areas by the Virginia Wilderness Act of 1984, Public Law 98-586, October 30, 1984.

## Abstract

Semiquantitative spectrographic analyses for 31 elements on 26 stream-sediment and 73 rock samples from the Barbours Creek and Shawvers Run Wilderness Study Areas, Craig County, Va., are reported here in detail. Atomic-absorption analyses for zinc in all samples are also reported. Brief descriptions are given of rock samples analyzed, which include sandstone, shale, and limestone. Localities for all samples are given in Universal Transverse Mercator (UTM) coordinates.

## INTRODUCTION

The analyses presented in this report (Table 1) are of 26 stream-sediment and 73 rock samples from the Barbours Creek and Shawvers Run Wilderness Study Areas, Va. (Fig. 1). These were collected by F. G. Lesure, and J. R. Estabrook in October 1985. Stream sediment samples were collected from most of the small drainage basins in the study area. These represent several handfuls, randomly collected, of the finest sediment available at the sample site in the stream. Rock samples analyzed are described briefly in a separate section of this report. All are chip samples taken across bedding or layering over a measured thickness of representative material from outcrops or road cuts. The samples are representative of the major rock types exposed in the area. Some of the rock is partly weathered, but generally the freshest material available was sampled. Debbie Kay (USGS) made X-ray diffraction identification of manganese minerals. Maps showing sample localities and discussion of the results of the analytical work are given by Lesure and Estabrook (in press).

## ANALYTICAL TECHNIQUES

Each sample was analyzed semiquantitatively for 31 elements by means of a six-step, D.C. (direct-current) arc, optical-emission spectrographic method (Grimes and Marranzino, 1968) by E. A. Bailey and Robin Sanchez in the USGS laboratories, Denver, Colo. In addition, most of the samples were analyzed for zinc by an atomic-absorption technique (Ward and others, 1969, p.20) by R. J. Fairfield and L. S. Laudon, USGS laboratories, Denver, Colo. 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 ten of these numbers) and are approximate midpoints of geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, etc. The expected precision is within one adjoining reporting interval on each side of the reported value 83 percent of the time and within two adjoining intervals 96 percent of the time (Motooka and Grimes, 1976).

The visual lower limits of determination for the 31 elements that were determined spectrographically are as follows:

For those given in percent:

Calcium	0.05	Magnesium	0.02
Iron	0.05	Titanium	0.002

For those given in ppm:

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

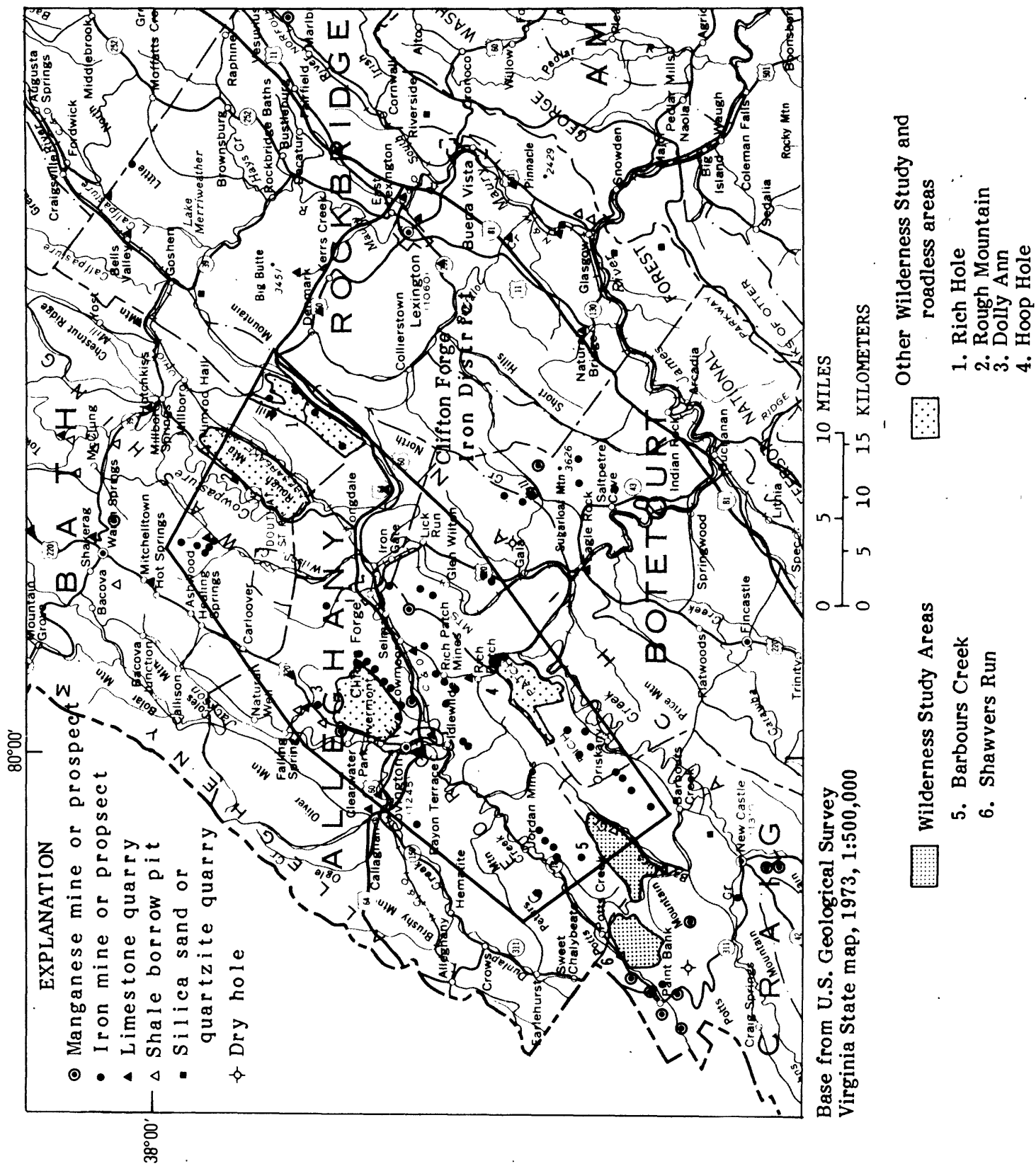


Figure 1.-- Map showing location of Barbours Creek and Shawvers Run Wilderness Study Areas.

Thirteen samples were analyzed for uranium by fluorometric methods by J. D. Sharkey , USGS Laboratories, Denver, Colo., as follows:

	ppm U		ppm U
Sample: VSR 021	11	VSR 139	3.5
VSR 024	3.4	VSR 142	3.3
VSR 029	1.8	VSR 151	2.9
VSR 133	7.8	VSR 152	3.3
VSR 136	1.0	VSR 153	1.8
VSR 138	.8	VSR 157	3.5
		VSR 161	3.5

#### ROCK DESCRIPTIONS

<u>Sample No.</u>	<u>Description</u>
VSR 001	1.5-m chip sample, sandstone, grayish-red-purple, medium- to coarse-grained, hematitic; contains abundant clay galls. Sp gr 3.00. Rose Hill Formation.
VSR 002	1.5-m chip sample, quartzite, white- to pinkish-gray, fine-grained. Keefer Sandstone.
VSR 003	2-m chip sample, sandstone, pale-brown to grayish-red, fine-grained, thin bedded. Juniata Formation.
VSR 004	2-m chip sample, chert and sandstone breccia, brown, limonite cement. Mineralized zone in Licking Creek Limestone.
VSR 005	1-m chip sample, sandstone, blackish- to dusky-red, very fine-grained, hematitic; contains abundant greyish-red and dark-reddish-brown clay galls. Sp gr 2.95. Rose Hill Formation.
VSR 007	2-m chip sample, sandstone, blackish-red, fine-grained, thin bedded. Sp gr 2.84. Rose Hill Formation.
VSR 008	2-m chip sample, quartzite, pale-brown to grayish-red, fine-grained, thin bedded. Tuscarora Quartzite.
VSR 009	1-m chip sample, sandstone, grayish-red-purple, very fine-grained, hematitic. Sp Gr 2.84. Rose Hill Formation.
VSR 010	1.2-m chip sample, sandstone, very pale-orange to white, very fine-grained, quartzitic. Keefer Sandstone.
VSR 011	1-m chip sample, sandstone, moderate-yellowish-brown, medium- to coarse-grained, porous, fossiliferous, minor limonite stain and cement. Clifton Forge Sandstone Member, Keyser Limestone.
VSR 012	2-m chip sample, sandstone, blackish-red, fine-grained, slabby, hematitic. Sp gr 2.84. Rose Hill Formation.

- VSR 013 Composite of chips from several boulders, sandstone, moderate-orange-pink to grayish-orange-pink, medium-grained, porous, fossiliferous, cross-bedded, friable, minor iron and manganese oxide stains. Clifton Forge Sandstone Member of Keyser Limestone.
- VSR 014 2-m chip sample, sandstone and chert breccia, brown, limonite cemented. Mineralized zone in Licking Creek Limestone.
- VSR 015 0.6-m chip sample, sandstone breccia, brown, limonite cement. Mineralized zone in Licking Creek Limestone.
- VSR 019 1.2-m chip sample, sandstone, reddish-brown, limonite cement, fine-grained. Mineralized zone in Licking Creek Limestone.
- VSR 020 1-m chip sample, sandstone, very-pale-orange to pale-brown, medium-grained, porous, minor limonite cement. Clifton Forge Sandstone Member of Keyser Limestone.
- VSR 021 1-m chip sample, shale, olive-black, fissile. Romney Shale.
- VSR 024 1-m chip sample, shale, dark-gray, weathers tan, fossiliferous. Romney Shale.
- VSR 029 1-m chip sample, shale, olive gray. Jennings Formation.
- VSR 033 1.2-m chip sample, sandstone breccia, reddish-brown, limonite cement. Mineralized zone in Licking Creek Limestone.
- VSR 034 Composite chip sample of two boulders, limonite containing sandstone and chert fragments, brown. Mineralized zone in Licking Creek Limestone.
- VSR 035 1-m chip sample, sandstone, grayish-red to moderate-brown, very fine-grained, arkosic. Juniata Formation.
- VSR 036 1-m chip sample, sandstone, light-gray, moderate-red stain, fine- to medium-grained. Keefer Sandstone.
- VSR 101 2-m chip sample, sandstone. Keefer Sandstone.
- VSR 102 1.5-m chip sample, sandstone, white to light-gray, fine- to medium-grained. Keefer Sandstone.
- VSR 103 1.5-m chip sample, sandstone, blackish-red, fine-grained, hematitic; contains clay galls. Sp gr 2.92. Rose Hill Formation.
- VSR 104 1-m chip sample, sandstone, light-grayish-orange, fine- to medium-grained, thin bedded, cross-bedded. Keefer Sandstone.
- VSR 107 1-m chip sample, limestone, medium- to olive-gray, fine-grained. Keyser Limestone.
- VSR 110 2-m chip sample, sandstone, conglomeratic, white to light-gray, light-brown stain, medium- to very coarse-grained, some granules and fine pebbles, porous, fossiliferous. Clifton Forge Sandstone Member of Keyser Limestone.

- VSR 111 2-m chip sample, sandstone, reddish-brown, limonite cement, porous. Mineralized zone in Licking Creek Limestone.
- VSR 112 1-m chip sample, sandstone, pale-yellowish-orange, fine- to medium-grained. Keefer Sandstone.
- VSR 113 0.7-m chip sample, sandstone, white to yellowish-gray, medium- to coarse-grained, porous, fossiliferous. Clifton Forge Sandstone Member of Keyser Limestone.
- VSR 116 1.3-m chip sample, sandstone, grayish-red, medium-grained, hematitic. Sp gr 2.73. Rose Hill Formation.
- VSR 117 1-m chip sample, sandstone, pale-orange to grayish-orange-pink, fine grained. Keefer Sandstone.
- VSR 118 2.5-m chip sample, sandstone, very-pale-orange, fine- to medium-grained. Keefer Sandstone.
- VSR 119 0.3-m chip sample, sandstone, dusky-red, fractured, very fine-grained, hematitic, limonite in fractures. Sp gr 3.13. Rose Hill Formation.
- VSR 120 1.5-m chip sample, sandstone, blackish- to grayish-red, fine-grained, hematitic, small clay galls. Sp gr 2.98. Rose Hill Formation.
- VSR 122 2-m chip sample, quartzite, moderate to moderate-orange-pink, fine-grained. Tuscarora Quartzite.
- VSR 123 1-m chip sample, sandstone, grayish-orange. Juniata Formation.
- VSR 125 2.5-m chip sample, quartzite, white to light-gray, conglomeratic, medium- to very coarse-grained. Tuscarora Quartzite.
- VSR 126 1.5-m chip sample, sandstone, blackish-red, fine-grained, hematitic; grayish-red clay galls. Sp gr 2.89. Rose Hill Formation.
- VSR 127 1.2-m chip sample, sandstone, blackish-red, fine-grained, hematitic. Sp. gr 2.88. Rose Hill Formation.
- VSR 128 0.2-m chip sample, quartzite, light-gray, light-red stain, fine- to medium-grained. Tuscarora Quartzite.
- VSR 129 1-m chip sample, sandstone, light-gray to tan, medium-grained, fossiliferous, porous. Clifton Forge Sandstone Member of Keyser Limestone.
- VSR 130 1-m chip sample, quartzite, light-gray, red stain, fine- to medium-grained. Tuscarora Quartzite.
- VSR 131 1.5-m chip sample, quartzite, white to light gray, fine-grained. Tuscarora Quartzite.

- VSR 132 2-m chip sample, sandstone, blackish-red, fine-grained, hematitic; minor moderate-red clay galls. Sp gr 2.95. Rose Hill Formation.
- VSR 133 0.5-m chip sample, shale, dark gray, weathers light gray, small brachiopods, Romney Shale.
- VSR 136 1.5-m chip sample, shale, medium-dark-gray to olive-gray. Jennings Formation.
- VSR 138 1.2-m chip sample, shale, medium-dark- to -olive-gray. Jennings Formation.
- VSR 139 1-m chip sample, shale, grayish-black, fissile. Romney Shale.
- VSR 140 1.2-m chip sample, sandstone breccia, limonite cemented. Keefer Sandstone.
- VSR 142 1-m chip sample, shale, dark-gray to black, Romney Shale.
- VSR 143 1-m chip sample, quartzite, pale-moderate-pink to white, very fine-grained. Tuscarora Quartzite.
- VSR 144 1-m chip sample, sandstone, light-gray, fine- to medium-grained. Keefer Sandstone.
- VSR 145 1.7-m chip sample, sandstone, blackish-red, fine-grained, hematitic; minor grayish-red clay galls. Sp gr 2.87. Rose Hill Formation.
- VSR 146 1.5-m chip sample, sandstone, light-gray, fine- to medium-grained. Keefer Sandstone.
- VSR 147 2-m chip sample, quartzite, very-pale orange light-brown stain, fine-grained. Tuscarora Quartzite.
- VSR 148 1.2-m chip sample, chert breccia, limonite cement, moderate-brown to grayish-red. Mineralized zone in Licking Creek Limestone.
- VSR 149 1-m chip sample, sandstone breccia, limonite cement. Mineralized zone in Licking Creek Limestone.
- VSR 151 1-m chip sample, shale, dark-gray, fissile. Romney Shale.
- VSR 152 1-m chip sample, shale, dark-gray, fissile. Romney Shale.
- VSR 153 1.5-m chip sample, shale, olive-gray. Jennings Formation.
- VSR 157 7-m chip sample, shale, dark-gray, fissile, fossiliferous. Romney Shale.
- VSR 158 1.5-m chip sample, sandstone, brown, porous, fossiliferous, limonite cement. Mineralized zone in Licking Creek Limestone.
- VSR 159 Composite chips sample of several boulders, sandstone breccia, pale-yellowish-orange; manganese oxide cement, grayish-black. Clifton Forge Sandstone Member of Keyser Limestone. Manganese mineral probably lithiophorite.



VSR 160	1.5-m chip sample, sandstone, white to pinkish-gray, fine-grained. Keefer Sandstone.
VSR 161	2-m chip sample, shale, olive-black. Romney Shale.
VSR 162	1-m chip sample, shale, white, very-pale-orange stain, fine-grained. Keefer Sandstone.
VSR 163	1-m chip sample, sandstone, dark-grayish-red, fine-grained, hematitic. Sp gr 2.99. Rose Hill Formation.
VSR 164	1-m chip sample, quartzite, white to light-gray, fine- to medium-grained. Tuscarora Quartzite.
VSR 201	1-m chip sample, sandstone, blackish- to grayish-red, very fine-grained, hematitic. Sp gr 2.97. Rose Hill Formation.
VSR 202	1-m chip sample, sandstone, brown, limonite cemented, fossiliferous. Mineralized zone in Licking Creek Limestone.

#### EXPLANATION OF TABLES

The X and Y coordinates are Universal Transverse Mercator (UTM) grid, zone 17. The X coordinate is the easting value, in meters; the Y is the northing, in meters.

Iron, magnesium, calcium, and titanium, concentrations are reported in percent (pct); all others are in parts per million (ppm). Letters below chemical symbols indicate the method of analysis: s, six-step semiquantitative spectrographic method; aa, atomic absorption. Other symbols on the table are: N, not detected; --, not determined; <, amount detected is below the lower limit of determination, which is number shown; >, amount detected is above the upper limit of determination, which is number shown.

Elements looked for spectrographically but not found, except as noted, are listed below. The lower limits of determination for these elements are in parentheses.

For stream sediments: As (200); Au (10); Bi (10); Cd (20); Sb (100); Sn (10); W (50); and Th (100). Exceptions: Samples VRH 002, 028, 112, 124, 200, 221, 226, 312, 333, and 337 reported to contain detectable Bi but less than 10 ppm; sample VRH 221 reported to contain 20 ppm Cd, and samples VRH 124, 301, 311, and 337 reported to contain detectable Cd but less than 20 ppm.

For rock samples: As (200); Au (10); Bi (10); Cd (20); Sb (100); Sn (10); Th (100) and W (50). Exceptions: Samples VRH 302, 303, and 304 reported to contain detectable Bi but less than 10 ppm; sample VRH 019 reported to contain 500 ppm Cd, samples VRH 031 and 201, 70 ppm Cd, and sample VRH 322, detectable Cd but less than 20 ppm; samples VRH 100 and 331 reported to contain 20 ppm Sn, samples VRH 126 and 130 reported to contain detectable Sn but less than 10 ppm; sample VRH 332 reported to contain detectable W but less than 50 ppm.

#### REFERENCES CITED

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- 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. Geological Survey Bulletin 1289, 45 p.

TABLE 1. ANALYSES OF ROCK SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Utm x	Utm y	Fe-pct. S	Mg-pct. S	Ca-pct. S	Ti-pct. S	Mn-pptm S	Ag-pptm S	B-pptm S	Ba-pptm S	Be-pptm S	Co-pptm S	Cr-pptm S
VSRO01	569,400	4,159,740	10.00	.07	.20	.100	100	N	20	200	1.5	<5	20
VSRO05	569,840	4,160,440	10.00	.07	.10	.150	200	N	50	70	1.0	<5	20
VSRO07	570,900	4,160,370	10.00	<.02	<.05	.100	150	N	50	300	<1.0	N	20
VSRO09	570,070	4,159,650	10.00	<.02	<.05	.150	150	N	50	200	1.0	N	10
VSRO12	572,700	4,160,750	10.00	<.02	<.05	.100	150	N	100	300	1.0	N	15
VSRO13	569,400	4,159,740	15.00	.07	.05	.100	100	N	100	100	1.0	<5	30
VSRO16	571,640	4,160,440	10.00	<.02	<.05	.050	150	N	50	100	1.5	N	<10
VSRO19	571,480	4,161,140	15.00	.03	<.05	.200	>5,000	N	150	500	2.0	30	30
VSRO20	571,350	4,161,620	10.00	.07	.07	.100	100	N	70	70	1.0	N	15
VSRO26	572,420	4,160,170	10.00	.05	.05	.100	150	N	100	150	1.0	<5	20
VSRO27	571,480	4,158,350	5.00	.20	.10	.300	150	N	150	150	1.0	<5	30
VSRO32	570,560	4,160,970	15.00	.05	.15	.200	200	N	150	70	1.0	5	30
VSRO45	573,790	4,161,110	10.00	.03	<.05	.150	150	N	150	300	1.0	<5	50
VSRO63	575,420	4,161,640	10.00	.02	.05	.100	150	N	100	100	1.0	N	<10
VSRO04	569,460	4,160,510	15.00	<.02	<.05	.070	200	N	<10	300	2.0	7	10
VSRO14	572,650	4,161,050	10.00	<.02	<.05	.015	200	N	<10	300	10.0	10	<10
VSRO15	572,540	4,161,250	15.00	<.02	<.05	.007	1,000	N	<10	200	1.5	5	<10
VSRO19	572,920	4,161,140	7.00	<.02	<.05	.100	150	N	<10	200	2.0	5	<10
VSRO33	579,470	4,161,400	20.00	<.02	<.05	.015	5,000	N	N	1,000	7.0	200	30
VSRO34	579,470	4,161,400	20.00	<.02	<.05	.010	>5,000	N	N	1,000	10.0	200	10
VSRO11	569,320	4,160,380	15.00	<.02	<.05	.010	150	N	<10	200	1.0	5	30
VSRO48	574,320	4,162,200	20.00	<.02	<.05	.015	1,000	N	N	200	7.0	150	20
VSRO49	577,180	4,159,490	15.00	<.02	<.05	.020	1,000	N	<10	300	5.0	7	10
VSRO58	578,590	4,160,860	10.00	<.02	<.05	.010	100	N	10	200	3.0	<5	20
VSRO59	578,470	4,161,110	10.00	<.02	<.05	.030	>5,000	N	10	3,000	1.0	2,000	N
VSRO21	569,350	4,159,730	10.00	.02	<.05	.100	500	N	20	300	1.0	7	10
VSRO22	569,990	4,161,020	5.00	<.02	<.05	.020	500	N	20	300	3.0	7	<10
VSRO40	571,180	4,161,780	5.00	<.02	<.05	.100	500	N	50	200	2.0	<5	N
VSRO02	569,260	4,159,680	.15	.02	<.05	.050	100	<.5	150	N	<1.0	N	<10
VSRO03	569,670	4,159,350	.70	.20	.10	.500	150	N	150	200	<1.0	<5	50
VSRO08	570,160	4,159,660	.10	<.02	<.05	.070	70	<.5	100	20	<1.0	N	N
VSRO10	572,070	4,162,100	.10	.02	<.05	.020	20	N	150	<20	<1.0	N	N
VSRO11	571,900	4,162,910	1.00	<.02	<.05	.020	50	N	30	50	1.5	N	N
VSRO13	572,640	4,160,930	.15	<.02	<.05	.050	1,000	N	20	50	<1.0	<5	N
VSRO20	573,350	4,162,120	2.00	<.02	<.05	.007	>5,000	N	10	500	<1.0	10	N
VSRO21	573,350	4,162,770	1.50	.50	<.05	.500	100	1.5	300	1,500	1.0	N	100
VSRO24	573,840	4,162,510	2.00	.70	<.05	.500	100	N	500	700	1.0	N	150
VSRO29	580,500	4,161,510	3.00	1.00	<.05	.500	700	N	200	500	1.0	20	100
VSRO35	578,570	4,163,620	3.00	.70	.05	.500	150	N	200	300	1.0	.5	70
VSRO36	576,080	4,160,490	.05	<.02	<.05	.020	10	N	150	N	<1.0	N	N
VSRO101	569,330	4,160,070	.10	<.02	<.05	.050	1,000	N	100	200	<1.0	<5	N
VSRO102	569,330	4,159,900	.50	<.02	<.05	.050	1,000	N	100	150	1.0	<5	N
VSRO104	569,180	4,159,550	.07	<.02	<.05	.050	20	N	150	<20	<1.0	N	N
VSRO107	568,840	4,160,440	.50	5.00	20.00	.020	500	N	70	<20	N	N	<10
VSRO110	568,990	4,160,400	.20	.03	.05	.015	300	N	70	50	<1.0	7	<10

TABLE 1. ANALYSES OF ROCK SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA--Continued

Sample	Cu-ppm S	La-ppm S	Mo-ppm S	Nb-ppm S	Ni-ppm S	Pb-ppm S	Sc-ppm S	Sr-ppm S	V-ppm S	Y-ppm S	Zn-ppm S	Zr-ppm S	Zn-ppm aa	U-inst
VSRO01	<5	50	<5	N	5	<10	10	<100	70	30	N	300	10	--
VSRO05	<5	30	N	N	<5	<10	7	<100	70	50	N	500	10	--
VSRO07	5	50	N	N	<5	N	5	<100	50	30	N	150	<5	--
VSRO09	5	20	N	N	<5	<10	5	100	70	50	N	500	10	--
VSRO12	<5	50	N	N	<5	N	7	150	70	30	N	500	<5	--
VSRO13	<5	20	N	N	5	N	7	N	100	30	N	300	10	--
VSRO16	5	N	N	N	5	<10	5	N	50	30	N	70	20	--
VSRO19	10	30	N	N	30	N	15	100	50	50	N	700	20	--
VSRO120	<5	30	N	N	<5	<10	7	<100	70	30	N	500	10	--
VSRO126	<5	20	N	N	5	N	7	<100	70	20	N	200	10	--
VSRO127	10	50	N	N	<5	<10	7	150	50	30	N	700	10	--
VSRO132	7	50	N	N	10	N	15	100	70	50	N	300	10	--
VSRO145	<5	70	N	N	5	N	10	150	70	50	N	700	20	--
VSRO163	<5	30	N	N	<5	<10	5	100	50	30	N	300	10	--
VSRO04	30	N	N	N	100	70	10	N	30	20	700	50	170	--
VSRO14	5	N	<5	N	200	10	5	N	20	15	700	50	120	--
VSRO15	10	N	N	N	70	N	N	N	<10	<10	500	20	65	--
VSRO19	<5	N	N	N	50	<10	N	N	10	10	200	70	55	--
VSRO33	15	N	<5	N	500	10	10	N	70	30	2,000	15	600	--
VSRO34	10	N	N	N	300	20	7	N	20	30	2,000	30	550	--
VSRO111	15	N	10	N	50	20	10	N	300	<10	200	50	N	--
VSRO148	50	N	<5	N	300	50	15	N	30	30	5,000	15	430	--
VSRO149	30	N	N	N	100	10	5	N	20	10	700	70	250	--
VSRO158	30	N	N	N	20	20	N	N	70	10	300	70	80	--
VSRO159	500	N	7	N	700	30	10	N	15	15	1,500	150	630	--
VSRO201	5	20	N	N	10	N	7	<100	50	30	N	500	15	--
VSRO202	10	N	N	N	70	15	N	N	15	15	200	200	80	--
VSRO140	5	20	N	N	15	20	N	N	10	10	200	300	50	--
VSRO02	<5	N	N	N	<5	<10	N	N	<10	<10	N	300	5	--
VSRO03	5	30	N	N	<5	N	5	N	20	20	N	>1,000	15	--
VSRO08	<5	N	N	N	<5	N	N	N	<10	N	N	100	<5	--
VSRO10	<5	N	N	N	<5	N	N	N	<10	N	N	70	5	--
VSRO11	7	N	N	N	20	10	N	N	<10	<10	<200	150	90	--
VSRO13	<5	N	N	N	<5	20	N	N	<10	N	N	100	15	--
VSRO20	7	N	N	N	7	<10	N	N	10	<10	200	30	120	--
VSRO21	10	50	300	<20	30	50	20	<100	300	30	N	150	5	11.0
VSRO24	50	70	7	<20	15	50	20	<100	200	20	N	150	25	3.4
VSRO29	70	50	N	<20	70	15	20	<100	100	30	N	150	20	1.8
VSRO35	7	50	N	N	15	<10	5	N	50	20	N	500	25	--
VSRO36	<5	N	N	N	<5	N	N	N	<10	N	N	200	N	--
VSRO101	<5	N	N	N	<5	N	N	N	<10	<10	N	300	10	--
VSRO102	5	N	N	N	<5	<10	N	N	<10	<10	N	200	5	--
VSRO104	<5	N	N	N	<5	N	N	N	<10	<10	N	300	5	--
VSRO107	<5	N	N	N	N	20	N	100	<10	<10	<200	50	310	--
VSRO110	5	N	N	N	20	<10	N	N	10	N	N	100	60	--

TABLE 1. ANALYSES OF ROCK SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA--Continued

Sample	Utm x	Utm y	Fe-pct. S	Mg-pct. S	Ca-pct. S	Ti-pct. S	Mn-ppm S	Ag-ppm S	B-ppm S	Ba-ppm S	Be-ppm S	Co-ppm S	Cr-ppm S
VSR112	568,950	4,159,770	.15	.02	<.05	.030	70	<.5	300	20	<1.0	N	N
VSR113	569,410	4,161,270	.10	<.02	<.05	.020	20	N	50	20	<1.0	N	N
VSR117	570,950	4,160,400	.15	<.02	<.05	.015	300	1.0	50	<20	<1.0	N	N
VSR118	570,290	4,160,680	.15	<.02	<.05	.020	700	N	200	200	<1.0	N	N
VSR122	572,460	4,160,210	.15	<.02	<.05	.150	100	<.5	150	50	<1.0	N	<10
VSR123	572,160	4,160,170	.30	.03	<.05	.070	100	N	50	70	<1.0	N	<10
VSR125	572,360	4,160,160	.10	<.02	<.05	.010	300	N	10	<20	<1.0	N	N
VSR128	571,940	4,159,680	.10	<.02	<.05	.007	1,000	<.5	50	30	<1.0	N	N
VSR129	569,650	4,161,540	.07	<.02	<.05	.050	200	N	20	<20	<1.0	N	N
VSR130	572,740	4,160,390	.20	<.02	<.05	.150	150	N	50	50	<1.0	N	N
VSR131	570,470	4,160,900	.20	<.02	<.05	.070	5,000	N	30	100	<1.0	7	N
VSR133	570,260	4,161,810	3.00	.30	<.05	.300	150	1.0	150	500	1.0	N	100
VSR136	569,160	4,161,870	5.00	.70	<.05	.500	700	N	150	700	1.0	30	150
VSR138	570,700	4,162,230	5.00	.70	<.05	.300	700	N	150	700	1.0	30	100
VSR139	570,850	4,162,020	3.00	.70	5.00	.300	1,000	N	200	2,000	<1.0	7	70
VSR142	570,070	4,162,740	3.00	.50	.10	.500	50	.5	200	700	1.0	N	150
VSR143	572,960	4,160,520	.15	.02	<.05	.150	100	<.5	100	70	<1.0	N	N
VSR144	573,760	4,161,090	<.05	<.02	<.05	.015	20	N	10	N	<1.0	N	N
VSR146	574,450	4,161,500	.15	<.02	<.05	.015	50	N	50	20	<1.0	N	N
VSR147	574,490	4,161,670	.15	<.02	<.05	.020	500	N	20	<20	<1.0	<5	N
VSR151	577,830	4,159,950	5.00	.50	<.05	.300	30	.5	300	1,500	<1.0	N	100
VSR152	578,070	4,159,550	5.00	.50	<.05	.300	30	N	200	1,000	1.0	N	70
VSR153	578,120	4,159,420	5.00	.70	<.05	.300	700	N	200	500	1.0	15	100
VSR157	581,870	4,163,390	7.00	.50	<.05	.300	50	<.5	300	500	1.0	<5	100
VSR160	578,130	4,162,340	.10	<.02	<.05	.020	15	N	150	<20	N	N	N
VSR161	580,630	4,162,340	2.00	.50	<.05	.500	30	1.0	300	700	1.0	N	150
VSR162	579,760	4,162,950	.10	<.02	<.05	.020	100	N	200	<20	<1.0	N	N
VSR164	575,550	4,160,950	.15	<.02	<.05	.070	20	<.5	150	<20	<1.0	N	N

TABLE 1. ANALYSES OF ROCK SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA--Continued

Sample	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sc-ppm s	Sr-ppm s	V-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Zn-ppm aa	U-inst
VSR112	<5	N	N	N	<5	N	N	N	<10	N	N	200	5	--
VSR113	<5	N	N	N	<5	N	N	N	<10	N	N	50	25	--
VSR117	<5	N	N	N	<5	N	N	N	<10	N	N	100	10	--
VSR118	<5	N	N	N	<5	N	N	N	<10	N	N	200	5	--
VSR122	<5	N	N	N	<5	<10	N	N	10	<10	N	500	<5	--
VSR123	<5	N	N	N	<5	N	N	N	15	10	N	100	<5	--
VSR125	<5	N	N	N	<5	<10	N	N	<10	N	N	50	N	--
VSR128	<5	N	N	N	<5	N	N	N	<10	N	N	100	N	--
VSR129	<5	N	N	N	<5	N	N	N	<10	N	N	70	5	--
VSR130	<5	N	N	N	<5	30	N	N	10	<10	N	700	<5	--
VSR131	5	N	N	N	<5	10	N	N	<10	N	N	300	5	--
VSR133	70	50	50	<20	<5	30	15	<100	500	15	N	100	5	7.8
VSR136	30	50	N	N	50	10	20	<100	150	30	N	150	50	1.0
VSR138	30	50	N	<20	50	10	20	<100	150	30	N	150	35	.8
VSR139	30	30	N	N	50	<10	15	150	70	15	N	70	10	3.5
VSR142	50	50	15	<20	20	20	20	<100	500	50	N	100	25	3.3
VSR143	<5	20	N	N	<5	10	<5	N	10	10	N	1,000	<5	--
VSR144	<5	N	N	N	<5	N	N	N	<10	N	N	50	<5	--
VSR146	<5	N	N	N	<5	10	N	N	<10	N	N	150	<5	--
VSR147	<5	N	N	N	5	20	N	N	<10	N	N	100	5	--
VSR151	100	50	150	N	5	30	20	<100	300	20	N	70	10	2.9
VSR152	50	50	15	<20	5	20	20	<100	200	30	N	150	130	3.3
VSR153	7	50	N	N	50	10	20	<100	100	30	N	150	75	1.8
VSR157	70	30	70	N	30	30	15	<100	300	20	N	100	25	3.5
VSR160	<5	N	N	N	<5	N	N	N	<10	<10	N	70	N	--
VSR161	50	50	20	N	20	50	20	<100	500	30	N	150	10	3.5
VSR162	<5	N	N	N	<5	N	N	N	<10	<10	N	200	N	--
VSR164	<5	N	N	N	<5	N	<5	N	<10	<10	N	1,000	N	--

TABLE 2. ANALYSES OF STREAM-SEDIMENT SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Utm x	Utm y	Fe-pct. S	Hg-pct. S	Ca-pct. S	Ti-pct. S	Mn-ppm S	Ag-ppm S	B-ppm S	Ba-ppm S	Be-ppm S	Co-ppm S	Cr-ppm S
VSRO06	570,860	4,163,180	2.0	.15	.20	.30	1,500	N	200	700	1.5	10	30
VSRO17	573,090	4,162,650	.7	.02	<.05	.10	700	N	200	100	1.5	7	<10
VSRO18	573,040	4,162,660	1.0	.07	<.05	.20	1,000	N	200	100	1.5	<5	10
VSRO22	573,340	4,162,990	1.5	.10	.05	.20	1,000	N	200	300	1.5	7	15
VSRO23	573,390	4,163,000	.3	<.02	<.05	.10	150	N	200	70	1.0	5	N
VSRO25	578,700	4,159,050	1.0	.15	.05	.30	700	N	200	300	1.5	10	30
VSRO26	579,190	4,160,050	.5	.02	<.05	.10	200	N	300	70	1.5	5	<10
VSRO27	580,000	4,160,880	.1	<.02	<.05	.05	15	N	200	<20	N	<5	N
VSRO28	580,720	4,161,600	.7	.03	.05	.10	300	N	200	200	2.0	7	<10
VSRO30	580,500	4,161,440	.5	.02	<.05	.10	150	N	200	150	1.5	5	<10
VSRO31	581,850	4,163,470	.3	.02	<.05	.07	500	N	200	70	1.0	<5	<10
VSRO32	582,880	4,164,890	.5	<.02	<.05	.10	200	N	200	70	1.0	<5	<10
VSRO105	569,740	4,159,280	.3	.02	.05	.10	150	N	200	50	<1.0	<5	<10
VSRO106	569,700	4,159,250	.7	.05	.05	.20	500	N	150	70	1.5	5	10
VSRO108	568,850	4,160,370	.5	.02	<.05	.15	700	N	150	200	1.5	7	<10
VSRO109	568,880	4,160,390	1.0	.05	.05	.20	200	N	200	300	1.5	<5	15
VSRO114	569,240	4,161,300	1.0	.05	<.05	.15	1,500	.5	150	300	2.0	7	10
VSRO115	570,960	4,163,250	.7	.03	<.05	.15	500	N	150	300	2.0	7	10
VSRO134	569,540	4,161,810	.7	.03	<.05	.20	1,500	N	150	200	2.0	5	<10
VSRO135	569,140	4,161,700	.5	.02	<.05	.15	1,000	N	150	150	1.5	5	<10
VSRO137	569,760	4,162,500	1.5	.07	.05	.15	500	N	200	1,000	2.0	10	20
VSRO141	570,130	4,162,710	2.0	.10	.05	.20	700	N	200	700	2.0	15	30
VSRO150	577,550	4,159,920	.2	<.02	<.05	.10	300	N	150	<20	1.0	<5	N
VSRO154	579,500	4,160,270	.7	.05	<.05	.20	700	N	200	150	1.5	5	10
VSRO155	581,280	4,162,010	.5	.02	<.05	.10	200	N	200	70	1.0	<5	<10
VSRO156	581,590	4,162,370	1.5	.07	<.05	.20	1,000	N	300	100	1.0	5	10

TABLE 2. ANALYSES OF STREAM-SEDIMENT SAMPLES FROM BARBOURS CREEK AND SHAWVERS RUN WILDERNESS STUDY AREAS, CRAIG COUNTY, VIRGINIA--Continued

Sample	Cu-ppm S	La-ppm S	Mo-ppm S	Nb-ppm S	Mi-ppm S	Pb-ppm S	Sc-ppm S	Sr-ppm S	V-ppm S	Y-ppm S	Zn-ppm S	Zr-ppm S	Zn-ppm aa	U-inst
VSR006	30	20	10	N	70	15	7	<100	100	20	<200	150	110	--
VSR017	10	20	<5	N	30	20	<5	N	30	10	<200	200	130	--
VSR018	5	N	<5	N	10	30	5	N	30	15	N	>1,000	55	--
VSR022	10	N	7	N	30	30	5	<100	70	20	<200	1,000	170	--
VSR023	<5	N	<5	N	15	<10	N	N	15	<10	<200	500	120	--
VSR025	10	30	5	N	30	20	7	<100	70	20	N	700	80	--
VSR026	5	N	N	N	15	10	N	N	15	10	N	300	50	--
VSR027	<5	N	N	N	N	N	N	N	<10	<10	N	1,000	10	--
VSR028	10	20	N	N	70	10	<5	N	20	20	200	150	160	--
VSR030	7	N	<5	N	30	15	N	N	20	10	200	150	130	--
VSR031	<5	N	N	N	10	15	N	N	10	<10	200	150	120	--
VSR032	<5	N	N	N	7	<10	N	N	15	15	N	1,000	55	--
VSR105	<5	N	N	N	7	<10	N	N	10	<10	N	150	30	--
VSR106	5	20	N	N	15	10	<5	N	15	10	N	100	40	--
VSR108	10	N	7	N	20	10	<5	N	30	<10	<200	150	85	--
VSR109	20	20	<5	N	20	15	5	N	50	20	N	100	60	--
VSR114	30	30	5	N	30	20	5	N	50	15	<200	200	100	--
VSR115	20	20	7	N	50	10	5	N	50	10	<200	150	100	--
VSR134	7	20	<5	N	30	15	<5	N	20	20	N	200	60	--
VSR135	7	20	<5	N	20	15	<5	N	20	15	N	200	40	--
VSR137	30	20	7	N	100	10	5	N	70	10	300	100	410	--
VSR141	30	20	<5	N	100	10	5	N	100	15	200	150	240	--
VSR150	<5	N	N	N	10	<10	N	N	<10	<10	N	200	45	--
VSR154	5	20	N	N	15	<10	5	N	20	10	N	200	40	--
VSR155	7	N	<5	N	20	<10	<5	N	15	10	N	150	65	--
VSR156	5	N	<5	N	10	15	5	N	70	15	N	1,000	35	--