UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Owyhee Canyon (NV-010-106) and the South Fork Owyhee River (NV-010-103A) Wilderness Study Areas, Elko County, Nevada

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CONTENTS

ILLUSTRATIONS

TABLES

STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral values, if any. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Owyhee Canyon (NV-010-106), and the South Fork River (NV-010-103A) Wilderness Study Areas, Elko County, Nevada.

INTRODUCTION

In May 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of a portion of the Owyhee Canyon (NV-010-106), and the South Fork River (NV-010-103A) Wilderness Study Areas, Elko County, Nevada.

The Owyhee Canyon Wilderness Study Area comprises 21,875 acres, about 34 mi^2 (88 km^2), and the South Fork River Wilderness Study Area comprises 7,842 acres, about 12 mi^2 (31 km^2) in the northwestern corner of Elko County, Nevada. They lie about 40 mi (64 km) west of Owyhee, Nevada (fig. 1). We were asked to study 13,525 acres, about 21 mi^2 (54 km^2) of the Owyhee Canyon Wilderness Study Area, and 5,180 acres, about 8 mi^2 (20 km^2) of the South Fork River Wilderness Study Area. Throughout this report, "Wilderness Study Area" and "study area" refer only to the area studied by the U.S. Geological Survey. Access to the study areas is limited to unimproved dirt roads to the canyon rim and to floating the river by raft from the YP Ranch to the 45 Ranch with access permission of landowners. The unimproved roads extend along the east, west, and north boundaries of the Owyhee Canyon Wilderness Study Area but cross a portion of the study area only near the north end (see fig. 1).

The canyons in the study area are composed of rhyolite and basalt. The South Fork of the Owyhee River extends the length of the study area and has exposed rhyolite flows beneath the basalt. No Pre-Tertiary rocks are visible beneath the volcanics, but there is evidence that the Owyhee Upland area was part of a Late Paleozoic deposition basin indicating the potential for metasedimentary and metamorphic rocks lying at depth beneath the study area (Milesnick, 1984).

The topographic relief in the study area is about 670 ft (204 m), with a 4,685 ft (1,428 m) elevation near the river and a maximum elevation of about 5,360 ft (1,634 m) along the canyon rim. The climate is arid to semiarid.

METHODS OF STUDY

Sample Medium

Heavy-mineral-concentrate samples provide information about the chemistry of certain minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which may be ore related, permits determination of some elements that are not easily detected in stream-sediment samples.

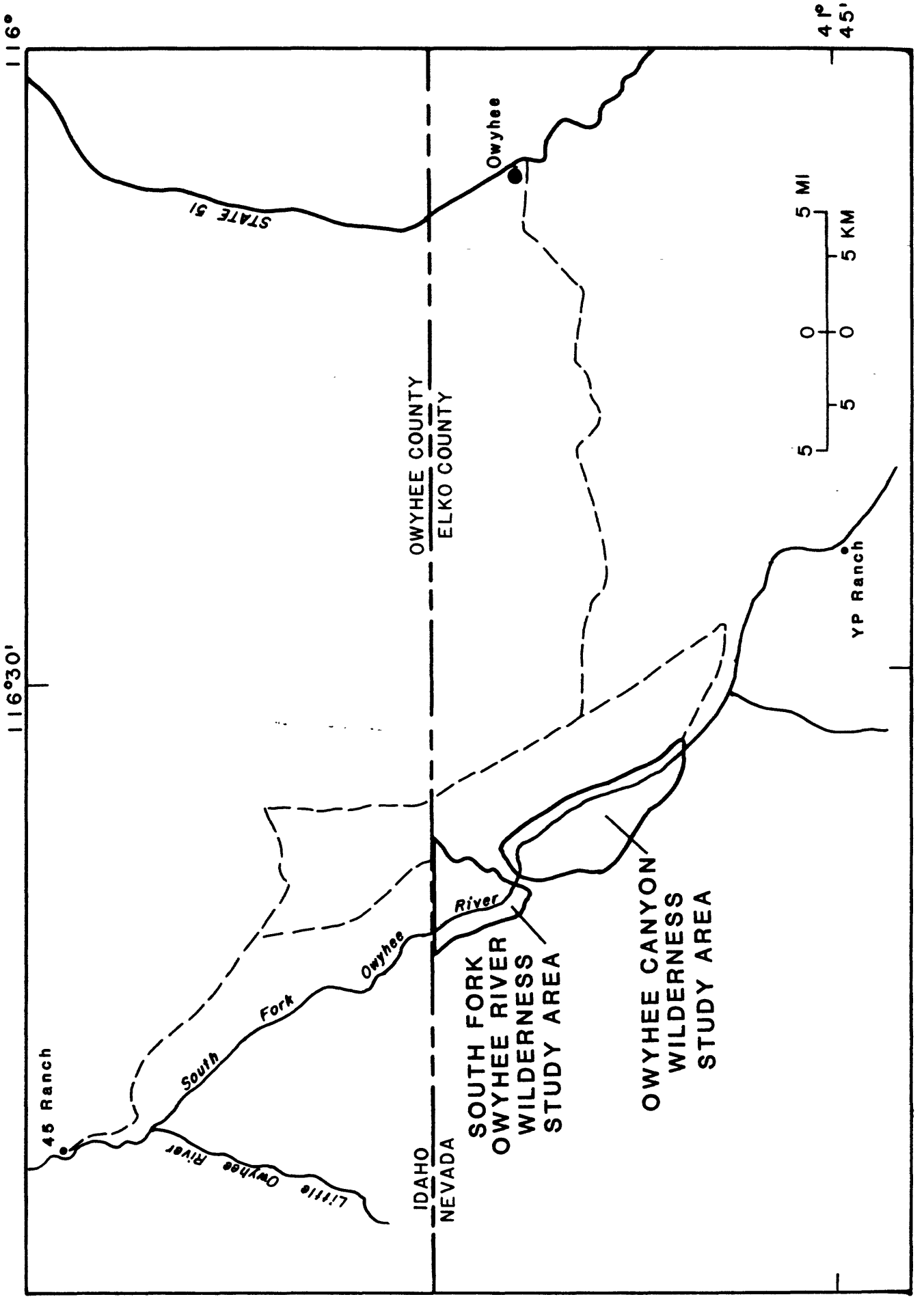

Figure 1. Location map of the Owyhee Canyon (NV-010-106) and the South Fork River (NV-010-103A) Wilderness Study Areas, Elko County, Nevada.

Sample Collection

Samples were collected at nine sites (plate 1). The average sampling density was about one sample site per 3.2 mi^2, based on the 29 mi^2 area sampled. The area of the drainage basins sampled ranged from 0.3 mi^2 to 1.5 mi^2.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from active alluvium primarily from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic maps (scale = 1:24,000). Each sample was composited from several localities within an area that may extend as much as 100 ft from the site plotted on the map. Each bulk sample was screened with a 2.0-mm (10-mesh) screen to remove the coarse material. The less than 2.0-mm fraction was panned until most of the quartz, feldspar, organic material, and clay-sized material were removed.

Sample Preparation

After air drying, bromoform (specific gravity 2.8) was used to remove the remaining quartz and feldspar from the heavy-mineral-concentrate samples that had been panned in the field. The resultant heavy-mineral sample was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for analysis/archival storage. The third fraction (the least magnetic material which may include the nonmagnetic ore minerals, zircon, sphene, etc.) was split using a Jones splitter. One split was hand-ground for spectrographic analysis; the other split was saved for mineralogical analysis. These magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a slope of 15, and a tilt of 10, with a current of 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate samples were analyzed for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination are listed in table 1. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. Values determined for the major elements (iron, magnesium, calcium, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data for samples from the Owyhee Canyon (NV-010-106) and the South Fork River (NV-010-103A) Wilderness Study Areas are listed in table 2.

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

DESCRIPTION OF DATA TABLE

Table 2 lists the analyses of the heavy-mineral concentrate samples. The data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location map (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. If an element was observed but was below the lowest reporting value, a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. Because of the formatting used in the computer program that produced the table, some of the elements listed in the table (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

REFERENCES CITED

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

Milesnick, Ted, 1984, Owyhee Canyonlands Wilderness Environmental Impact Statement Draft: U.S. Department of the Interior, Bureau of Land Management, p. III-16.

VanTrump, George, Jr., and Miesch, A. T., 1977, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.

TABLE 1.--Limits of determination for the spectrographic analysis of heavy-mineral concentrates based on a 5-mg sample

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.1	50
Magnesium (Mg)	.05	20
Calcium (Ca)	.1	50
Titanium (Ti)	.005	2
	Parts per million	
Manganese (Mn)	20	10,000
Silver (Ag)	1.0	10,000
Arsenic (As)	500	20,000
Gold (Au)	20	1,000
Boron (B)	20	5,000
Barium (Ba)	50	10,000
Beryllium (Be)	2	2,000
Bismuth (Bi)	20	2,000
Cadmium (Cd)	50	1,000
Cobalt (Co)	10	5,000
Chromium (Cr)	20	10,000
Copper (Cu)	10	50,000
Lanthanum (La)	50	2,000
Molybdenum (Mo)	10	5,000
Niobium (Nb)	50	5,000
Nickel (Ni)	10	10,000
Lead (Pb)	20	50,000
Antimony (Sb)	200	20,000
Scandium (Sc)	10	200
Tin (Sn)	20	2,000
Strontium (Sr)	200	10,000
Vanadium (V)	20	20,000
Tungsten (W)	100	20,000
Yttrium (Y)	20	5,000
Zinc (Zn)	500	20,000
Zirconium (Zr)	20	2,000
Thorium (Th)	200	5,000

TABLE 2--Spectrographic analyses of heavy-mineral-concentrate samples from the Owyhee Canyon and South Fork Owyhee River Wilderness Study Areas, Elko County, Nevada

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

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
OH001H	41 48 56	116 31 8	.2	.07	10	1.0	100	N	N	N	50	7,000	N
OH002H	41 50 28	116 33 46	.2	.10	50	.2	100	N	N	N	50	>10,000	N
OH003H	41 50 22	116 34 0	.2	.20	5	1.0	100	N	N	N	50	1,000	N
OH004H	41 50 47	116 34 18	.5	1.00	20	1.5	150	N	N	N	50	1,000	N
OH007H	41 54 13	116 36 27	.3	.10	5	1.0	100	N	N	N	50	3,000	N
OH009H	41 56 33	116 38 27	.2	.10	20	.7	100	N	N	N	20	700	N
OH010H	41 57 7	116 39 16	.2	.10	50	.2	100	N	N	N	50	>10,000	N
OH013H	41 58 23	116 41 45	.2	.10	10	.3	50	N	N	N	50	>10,000	N
OH014H	41 58 49	116 41 46	.2	.05	10	.2	100	N	N	N	50	>10,000	N

TABLE 2.--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
OH001H	N	N	N	30	<10	100	N	N	N	20	N	50	N	1,000
OH002H	N	N	N	50	<10	200	N	N	N	500	N	20	20	1,000
OH003H	N	N	N	50	<10	50	N	N	N	N	N	50	N	200
OH004H	N	N	N	100	<10	100	N	N	N	N	N	30	N	700
OH007H	N	N	N	30	<10	70	N	N	N	N	N	10	N	500
OH009H	N	N	N	70	<10	100	N	N	N	N	N	10	N	700
OH010H	N	N	N	100	<10	200	N	N	N	20	N	20	N	2,000
OH013H	N	N	N	N	<10	150	N	N	N	N	N	20	N	1,000
OH014H	N	N	N	50	<10	100	N	N	N	N	N	10	N	500

TABLE 2.--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
OH001H	50	N	300	N	>2,000	N
OH002H	50	N	300	N	>2,000	N
OH003H	50	N	200	N	>2,000	N
OH004H	50	N	500	N	>2,000	N
OH007H	50	N	200	N	>2,000	N
OH009H	50	N	200	N	>2,000	N
OH010H	50	N	500	N	>2,000	N
OH013H	20	N	300	N	>2,000	N
OH014H	20	N	200	N	>2,000	N